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Fertilized Ponds Produce More Fish ..... *Better Crops* 1
Artificial Breeding Results ..... *Jersey Bulletin* 4
Depth of Moisture and Yield of Wheat ..... *Soil Conservation* 7
Force Molting of Hens ..... *California Cultivator* 11
Sheep Parasites ..... *Sheep Breeder* 14
Handling the Draft Stallion ..... *Southern Planter* 15
New Method of Apple Propagation ..... *Kansas Farmer* 17
Regulation of Agriculture in Russia ..... *Pennsylvania Farmer* 18
New Way to Put Up Hay ..... *Capper's Farmer* 23
The Redwoods of California ..... *Armour* 25
Home-Grown Power ..... *Nebraska Farmer* 29
Treating Farm Canvas ..... *Ohio Farmer* 32
How to Save Girdled Apple Trees ..... *American Agriculturist* 34
Grass Plus Grain for Poultry ..... *Successful Farming* 37
Side-dressing Cotton and Corn ..... *Southern Agriculturist* 40
Isolation—Insulation ..... *Hog Breeder* 42
Plans to Prosper ..... *Nation's Business* 47
Feeding Calves for Baby Beef ..... *Shorthorn World* 51
Some Like It Hot—Some Like It Cold ..... *Ayrshire Digest* 55
Electrocution of Farm Flies ..... *Electricity on the Farm* 58
Sanitation in Farm Feeding ..... *Rural New-Yorker* 60
Efficient Farming ..... *The Farmer* 63
Successful Painting ..... *Eastern States Cooperator* 66
Delayed Spraying of Tomatoes ..... *Farm Research* 71
Worms, Lice and Mange ..... *Poland China Journal* 74
Disease Resistant Potatoes ..... *N. J. Farm and Garden* 77
Fertilizing for Fruit ..... *American Fruit Grower* 84

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The Farmer's Digest

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Fertilized Ponds Produce More Fish

Condensed from Better Crops with Plant Food

Donald L. Robertson

Editor, Agricultural Extension Service, Alabama Polytechnic Institute, Auburn, Ala.

TO 99 out of every 100 persons, fertilizer is synonymous with plant growth and better cotton or corn or some other crop. Yet the time may not be far distant when fertilizer manufacturers will add a new, recommended use for their product—the growing of fish. And before long landowners, farmers, and the city business man may be speaking of his per-acre production of fish as compared to pounds of seed cotton or corn per acre.

Tests conducted in Alabama during the past 4 years have shown that as much as 580 pounds of fish per acre of pond can be produced annually by proper fertilization. This much fish would mean more meat, aside from the sport of catching them, than the average beef cattle or hog producer can grow on the same amount of land. That is, if one could technically or untechnically consider fish as meat.

However, as with cotton, corn, and other crops, these tests have proven that fish ponds also need a balanced fertilizer for maximum results.

Comparatively little has been said about this new use of fertilizer, and yet the principle is simple. The fertilizers feed small plants, some microscopic, which in turn furnish food for the fish. These plants float through the water, and if present in sufficient amounts, give the water a light green or brown color. In addition, these plants are eaten directly by several species of fish and also furnish food for insects, tadpoles, crawfish, and other small animals upon which the fish feed.

The abundance of these plants can be increased by the use of balanced fertilization, and the in-

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crease in plants will in turn increase the pounds of fish produced per acre.

There are hundreds of ponds over the South which, while devoted to fish raising, are sadly lacking in fertility. Ranging from "mud puddles" to lakes, these ponds offer water for fish to swim in, but little if any food. For many years Director M. J. Funchess of the Alabama Experiment Station had wondered why fish could not be grown successfully in these ponds. For the past 4 years H. S. Swingle, fish culturist of the station, has been finding out that fish could be grown in any farm pond by adding fertilizer to the water.

Fertilization was only one of the phases of fish culture on which Mr. Swingle worked. But in the study he found that plants furnish most of the food and that fertilization furnishes food to these plants. Unfertilized ponds have produced from 100 to 200 pounds of fish per acre, and properly fertilized ones have produced as high as 580 pounds per acre. In an experiment, which was repeated more than once, two ponds of identical size, design, and structure were stocked. Pond No. 1 was stocked at the rate of 180 pounds of fish per acre, and pond No. 2 was stocked at the rate of 2 pounds, 5 ounces per acre. The following results are typical: At the end of 1 year, pond No. 1 produced 92 pounds of fish, and pond No. 2 produced 105 pounds. Analyses of the water showed that an almost identical food supply was available in each pond. This experiment indicates that heavy stocking is useless, and that the amount of fish which can be produced per acre is mainly dependent upon food supply. Therefore, if the pond is available, probably the most important consideration is how the fish can be fed for good growth. If it is desired to produce more pounds of fish per acre of water, fertilizer should be used.

Potash furnished part of the plant food in the mixture of fertilizers which Swingle found to be most profitable. Ammonia, 16 per cent superphosphate, and basic slag or ground limestone were other fertilizers found best in the pond-plants' diet. The most profitable mixture he has found for each application per acre of water is 5 pounds muriate of potash, 40 pounds sulphate of ammonia, 60 pounds superphosphate, 30 pounds basic slag or 15 pounds ground limestone.

The same results were obtained when the fertilizers were applied separately and when mixed just before they were applied. Basic slag cannot be mixed with the other materials and stored for any length of time, as it causes loss of ammonia. Approximately

the same results were obtained by using 100 pounds of a commercial mixture of 6-8-4 plus 10 pounds of nitrate of soda per acre at each application.

Best results were secured when the first application of fertilizer was applied in the spring as soon as the danger of floods was past (usually April or May). When the pond had not been previously fertilized, two to three applications were made at weekly intervals. After this, applications were made whenever the water became clear (approximately every 4 to 6 weeks), with the last application in September. The ponds thus received 8 to 10 applications per year. The cost per acre varied from $10 to $14.

Various methods of applying the fertilizer were studied, and it was found that methods depended upon the size of the ponds. The method that seemed to be best for small ponds was for the fertilizer to be applied by walking along in the edge of the water and broadcasting it towards the deeper water. No attempt was made to completely cover the pond, as the wave action gradually spread the fertilizer over the entire pond. At the same time, care was taken not to apply any of the fertilizer right at the edge of the water, as this would encourage the growth of weeds.

In large ponds the fertilizer was broadcast from boats over the area where the water was from 1 to 5 feet deep.

Fertilization is one of several factors that must be kept in mind in planning the home fish pond. There is, for instance, the matter of construction, stocking, protection of the fish from animals, and the caring for the pond. Each of these is important if one is to attain success in fish production.

However, gathering the data on proper fertilization is perhaps the first in importance. Swingle's results so far indicate that a great deal of progress is being made, and he is continuing and expanding the experiments. Fish ponds may not become as common as the home garden or the family plow mule, but with sport and fish available for the pond owner and friends at $10 to $15 per acre, there is every indication that there may be an increase among urban landowners and farmers. Further experimental work may reduce the annual fertilizer bill for the fish producer. Then, too, there is still the commercial angle which might open a new income route for the farmer.

Artificial Breeding Results

Condensed from The Jersey Bulletin

Dr. J. A. Henderson

IN reporting our results, I wish first to explain how they are calculated. All cows bred previous to December 10 and which have not since come in heat were designated as pregnant, unless we had definite knowledge to the contrary. This gives a fairly accurate picture of the first three bulls but flatters the record of the other five. The first three bulls have been in service since May and most of the pregnancies credited to them have been checked. In regard to the other five, their period of service is much shorter and probably at least 10 per cent of their credited pregnancies will prove empty.

Up to December 10, 762 cows had been inseminated. One thousand eighty-nine inseminations were made and 568 cows are apparently pregnant for a rate of 1.91 inseminations per conception.

These results certainly do not justify the rosy dreams of those who believed artificial insemination to be a panacea for all their breeding difficulties. We would like very well to have been able to report at this time that we had inseminated 762 cows and have that number in calf and with that number of services. Of course, no one expected every cow to conceive. But nevertheless, we can assume that in almost every case a healthy ovum was liberated and certainly living sperm were always introduced. Why, then, did not every cow conceive? The answer is not easy to arrive at. Probably most cases of infertility are not due to a single defect but to a summation of several factors. It is true, of course, that a single factor, i.e., failure of the female to ovulate, may render a mating sterile. But I believe most sterile matings are due to a group of causative factors, each of which lowers fertility to some extent and the sum total of which depresses that fertility below the threshold of conception. I do not profess to know what all those multiple factors were in each individual instance where our insemination proved fruitless. But I would like to discuss briefly what I consider to be a few of the most important reasons why we wasted something over 400 inseminations.

Probably the most important factor is related to the time relationship of the reproductive mechanism of the cow. It seems

Reprinted by permission from the Jersey Bulletin, Indianapolis, Ind., Feb. 15, 1939

fairly well established that ovulation takes place in the cow from 30 to 40 hours after the onset of heat. Since spermatozoa seldom survive more than 24 hours in the genital tract of a normal cow and probably much less under suboptimum conditions, it follows that for best results insemination should take place within a fairly narrow time range somewhere near the disappearance of the external signs of heat. The stage of heat was recorded at the time of 727 of our inseminations. Four classes were used, i.e., early, full, late and off heat. Fifty-nine in early heat resulted in 25 pregnant and 34 non-pregnant. Three hundred sixty-six in full heat resulted in 203 pregnant and 163 non-pregnant. Two hundred twenty-seven in late heat resulted in 121 pregnant and 106 non-pregnant. Sixty-five off heat resulted in 30 pregnant and 35 non-pregnant. This was a very rough classification and probably a good proportion of those recorded as early or full heat were actually in the later stages.

In Russia it has been observed repeatedly that 30 to 40 per cent of apparently normal cows fail to conceive after a single service. At several of their collectivized farms, they instituted the practice of inseminating twice during a heat period at intervals of from 10 to 18 hours. Of 17,000 apparently normal cows so treated, 90 per cent are reported in calf. Obviously this procedure is quite impractical in an association such as ours and, were it practical, I do not believe we could approach their results with our New Jersey cows. So it would appear that, given relatively fertile animals, we must still expect approximately one third of the cows to come back after one insemination.

It must also be remembered in analyzing these results that the dairymen of New Jersey have for years past followed the practice of importing a large proportion of their replacements. It is estimated that the annual importations reach a number equal to about one-eighth of the total cow population of the state. This may or may not be an economical procedure but it most certainly is not conducive to the maintenance of high breeding efficiency. Quite frequently these cows were put on the market for a reason and not infrequently that reason has been an unsatisfactory breeding history. Further I will draw attention here to the fact that but a small percentage of the cows on which we work are in Bang tested herds.

Still another factor which has had a depressant effect upon our conception rate is partial sterility of at least three of our bulls. The records of bulls 1, 3 and 8 were less satisfactory than the rest. Number 3 was used for so short a

period that his record bears little significance. The defect of number 8 may possibly be explained as due to the fact that he was trucked for some distance to new surroundings just before going into regular service and a sterile period frequently follows such treatment. At present he seems to be improving. In the case of number 1, a satisfactory explanation for his failure has so far evaded us. Samples of his semen, both fresh and stained, have been examined by a number of competent authorities and in no instance has an unfavorable report been given. The resistance of his sperm seems at least equal to that of the other bulls and fair motility has been observed after six days in refrigerated samples. He is fed just enough of a standard dairy ration to keep him in fair breeding shape. During the summer about two cupfuls of blood meal was added to his ration. Blood meal has been reported by Russian workers to increase the volume and resistance of the ejaculate but no change was observed in this bull from its addition to his ration. His diet may not be satisfactory but at least the number 2 bull seems to do well on it.

The same may be said in regard to exercise. All the exercise these bulls get is what they take themselves but, here again, one gets as much as another. However, it may be a mistake to look at the problem in that way. Definite knowledge of the nutritional requirements of a bull in heavy service is still lacking. The requirements of certain of the accessory food factors may vary in different individuals and what may be adequate for one may cause deficiency in another. Moreover, we are probably not justified in assuming that because one bull does fairly well without forced exercise, such exercise is unnecessary. I believe that the fertility of any one of our bulls would be promoted by a daily walk of an hour or two in an exerciser or treadmill.

Depth of Moisture and Yield of Wheat

Condensed from Soil Conservation

R. R. Hinde

Associate Agronomist, Soil Conservation Service

RECOGNIZING that moisture is a limiting factor in wheat production in the Southern Great Plains, the Soil Conservation Service technicians in the project and camp areas are assisting farmers in their crop planning by taking soil samples to determine the depth and amount of moisture accumulations in the soil.

The average rainfall in the Southern Plains is approximately 18 inches but the variance during individual years is wide. As a whole, the area is highly favored in the distribution of annual rainfall, approximately two-thirds of the moisture coming from April to September, through the summer growing season. Moisture available during this growing period points to but one conclusion —that greater crop utilization can be made of the moisture that falls than has been done in the past.

In the Great Plains, where crop production is carried on under low annual rainfall conditions, the loss by run-off and evaporation of 9.3 inches of this moisture is a serious handicap in the production of a wheat crop. Only that retained in the soil and saved from loss by run-off and evaporation is available for plant use. Contour farming operations, supported by terraces and tillage practices that will increase the absorptive capacity of the soil and thus reduce the run-off and evaporation, are valuable in retaining moisture that otherwise might be lost.

Late plowing, listing, and one-waying are unsatisfactory methods of preparing a seedbed for wheat. These methods permit large losses of moisture through weed growth after harvest; also, a poor seedbed is usually the result of such practices. The seedbed which is prepared late is often dry, loose, and in poor tilth. Early listing, followed by a ridge-buster and a duck-foot cultivator later, has proved satisfactory from the standpoint of moisture conservation and good seedbed preparation.

The difficulty in producing wheat in the Great Plains is that the wheat farmer must prepare his seedbed and do his planting at least 9 months in advance of harvest. During this time rains may come, or they may not, re-

Reprinted from Soil Conservation, Washington, D. C.

sulting either in a profitable crop or loss of a crop. For this reason, wheat farmers continue to seed wheat in the fall and take a chance on making or losing a crop. A flexible cropping system, which takes into consideration the soil moisture and fertility conditions of the field at each planting time, should be used where wheat is grown. Where this plan is used, a crop should be planted only when the moisture and residues are favorable—this in order that some assurance may be had for a profitable production and a vegetative cover for the land. It has been definitely determined by experiment stations in the Great Plains that the best land use and the highest economical returns can be secured by normal planting with favorable subsoil moisture conditions at planting time. In the case of wheat planting, 24 inches of moisture depth at seeding time is considered a safe margin. When moisture and residues are lacking, wheat should not be planted, or at least the acreage should be materially reduced. Soils of the Great Plains, where moisture is the limiting factor in crop production, are usually high in plant food content and have lost very little fertility due to leaching and removal by crops. The fertility, as a rule remains relatively constant and does not require regular cropping rotations, addition of commercial fertilizers, or the growing of legumes to restore nitrogen. Nitrogen is largely supplied in the western soils by the action of nitrogen-fixing bacteria living in the soils on decayed organic matter. The returning of crop stubble and residue to the soil, to replenish the organic content, is important in western agriculture.

As a result of studies made over a long period of time, A. L. Halsted and O. R. Mathews of the Division of Dry Land Agriculture in the Department have devised a method whereby the wheat farmer can forecast, fairly accurately, his chances of producing a profitable wheat crop. These two men discovered that the moisture already in the soil at planting time is a reasonably accurate index to the next year's harvest, and that the rains coming between seeding time and harvest time have little effect upon the yields of wheat.

These results and fact-finding data, which Halsted and Mathews compiled at the various dry land experiment stations, are something that the wheat farmer may use on his own farm in order to determine his chances of a profitable crop. By the simple use of a posthole digger, tile spade, or soil auger, the depth of moisture in the soil may be determined. If the depth is less than 24 inches, a favorable wheat crop is uncertain.

If this practice is used by the wheat farmers every year there will be fewer wheat failures, and also an expansion of other crops planted as substitutes for wheat.

By the use of such soil-moisture tests the farmer may be able to decide early in the spring whether or not the wheat crop planted in the fall should be abandoned or left on the land for harvest. In the case of abandonment, the land may be prepared for another crop; or it may be summer fallowed early enough to prepare a good seedbed and conserve the early spring rains.

Observations of 84 wheat crops from 1924 to 1937, made by H. H. Finnell, at the Panhandle Agricultural Experiment Station, Goodwell, Okla., showed that a forecast of wheat yields could be approximated by considering four factors previous to or at the time of seeding. These factors are (1) July rainfall, (2) soil moisture depth in the fall, (3) amount of available nitrogen in the soil, and (4) the amount of unrotted vegetable matter in the soil.

Where all 4 factors were favorable, 6 crops produced 30 bushels; where 3 factors were favorable, 16 crops produced 20.5 bushels; where 2 factors were favorable, 23 crops yielded 9.5 bushels; where 1 factor was favorable, 34 crops yielded only 1.25 bushels, and where no factors were favorable 5 crops yielded one-third bushel. A summary in tabular form of field tests made at Clovis, N. Mex., Vega, Tex., Liberal, Kans., Hereford, Tex., and Perryton, Tex., is presented below. The table shows percentage of fields falling in each soil-moisture depth classification.

Probabilities of obtaining specified yields of wheat in soil dry or wet to designated depths at seeding time, as determined by the Division of Dry Land Agriculture, U. S. Department of Agriculture, Hays, Colby, and Garden City, Kans.

Depth of moisture at seeding time	Percentage of chances of obtaining specified yields				
	Failure	5 to 10 bushels	10 to 20 bushels	20 to 30 bushels	30 or more
Soil dry	71	11	18	0	0
Wet 1 foot	34	23	24	19	0
Wet 2 feet	34	23	24	19	0
Wet 3 feet	10	6	14	47	23

Yields (bushels per acre)	Soil-moisture depth				
	0 to 6 inches	6 to 12 inches	12 to 24 inches	24 to 36 inches	36 to 42 inches
	Percent of fields	Percent of fields	Percent of fields	Percent of fields	Percent of fields
Failure	18	36	50	31	..
1 to 5	13	8	10	14	10
6 to 10	41	24	12	17	10
11 to 15	19	18	17	22	30
16 to 20	9	11	10	10	30
21 to 25	..	8	1	5	20
26 to 30	..	..	..	..	..
31	..	..	..	1	..
	100	100	100	100	100

Inside Coating for Silos

THE juices which are so essential to the preservation of silage tend to disintegrate masonry silos. A material, "Inertol," has been developed to be painted or sprayed on the inside surface of silos for protection. If the silo has been used, it is absolutely necessary to scrape off all the scale with a wire brush before applying the protective coating.

This material will cost from $2 to $3 per gallon, depending on the quantity purchased. One laborer can cover about 600 square feet with two coats in an eight-hour day. One gallon will cover about 100 square feet of concrete and 200 square feet of steel with two coats. It takes from 24 to 48 hours to dry. About 1,200 square feet can be covered per day with a spray outfit.

Plaster

The inside of masonry silos may be plastered if they become badly etched or absorb too much of the silage juices. A good plaster for this purpose can be made with one sack of portland cement, ten pounds of hydrated lime and two and one-half cubic feet of clean, well graded sand. Either one or two coats of plaster may be needed. Where only one coat is needed it can be from three-eighths to one-half inch thick. In case of two coats the first one should be one-fourth inch thick and should be allowed to cure for 24 hours before the second coat is applied.

It is essential to clean the inside surface of the silo thoroughly before plastering.

—*Pennsylvania Farmer*

Force Molting of Hens

Condensed from California Cultivator

Poultry Council, State College of Washington

IT is natural for hens to molt in late summer or early fall. For many years, poultrymen have made it a practice to rest their breeding flocks prior to the hatching season in order to insure higher egg production, better hatchability and stronger chicks. But not all hens molt at the same time, therefore, in recent years, there has been a tendency to force all hens to molt together.

In Washington it seemed that it would be desirable to force molt commercial flocks in order to remove some cheap eggs from the market in summer and to get high priced eggs in the fall. A few flocks were force molted as a field trial during 1932. Most of these reported satisfactory results. The next year a larger number of people force molted their flocks with approximately the same per cent of success. A greatly increased number molted their flocks in 1934 with a majority of them reporting satisfactory results. Generally speaking, those who have adhered closely to the schedule, or have made only slight modifications to fit the conditions of their flocks, have succeeded.

The summer force molt has made it possible to secure higher production and better egg quality during the fall and early winter months when egg prices are most favorable. Many poultrymen with limited housing facilities have found that the summer force molt has enabled them to utilize their poultry houses more efficiently by disposing of their force molted flock before the brooding season. Past experience has shown that it is seldom profitable to keep force molted flocks after February 1.

Analysis of Flock Records

No. of birds force molted	19105.0
No. of birds died till Jan. 1	915.0
Average date molt started	July 7
Per cent lay on date molt started	51.7
Av. per cent lay, high month following molt	49.8
Labor income in cents per bird till Jan. 1 (6 mos.)	54.4
Labor income in cents for 72 flocks not molted same year (12 mos.)	63.0

The use of all-night light seems to be important. In Kings County seven flocks under all-night light made an income of 67.3 cents while five flocks with part-time light made an income of 22.6 cents. In Whatcom County where all flocks were under all-night light the income was 81.8 cents.

Reprinted by permission from the California Cultivator, 317 Central Ave., Los Angeles

Fall Production	Oct.	Nov.	Dec.
	%	%	%
Force Molted Flocks	55.4	56.2	63.1
Non-Molted Flocks	35.0	38.8	38.8

As indicated in the table, flocks that have been force molted in mid-summer lay more eggs during the season of high priced eggs. They also lay eggs that run from 20 to 35 per cent higher in top grade eggs.

Early hatched hens are more successfully force molted than are hens hatched after April 1. It is not advisable to force molt flocks of yearling hens that have not maintained satisfactory egg production during the winter and spring months. It is also not advisable to force molt flocks that are not in good physical condition, or show evidence of disease or parasitic injury. This should apply particularly to flocks that are known to have been seriously injured by attacks of coccidiosis at some previous time. Observation has shown that flocks so injured suffer heavy mortality during the molting period and very seldom maintain a profitable production following the molt. It is usually not profitable to force molt hens that are 2 years old or over.

Methods of Procedure

The flock to be force molted should be rigidly culled. Remove all hens that are sick, overfat, and those that have molted during the spring. After culling the flock should be as uniform in health and condition as possible. Examine birds for lice and worms when the flock is culled and treat them immediately if any are found.

The period between July 1 and July 15 is usually considered as the best time to start the summer force molt.

During molting period: This period continues until egg production ceases and feathers drop.

Confine birds to the house or to house and sun porch; but have a total of at least four square feet of floor space per bird.

Remove all mash.

Take water from birds for twenty-four hours the first day and then every afternoon until production takes a drastic drop. Provide enough drinking space to prevent crowding when water is restored.

Feed grain sparingly, about six pounds a day, per 100 birds, in three equal feeds for the first five days, then eight to nine pounds daily throughout this period. The amount of grain should be increased slightly for flocks that are thin, and decreased for flocks where a majority of the hens are overweight. The grain fed during this period may be about half heavy white oats.

Mix the equivalent of one pint of good grade cod liver oil or fish oil in each 100 pounds of scratch grain. The oil should be mixed

each evening with the next day's scratch ration so that it will have a chance to soak into the grain overnight.

Feed green feed at the rate of not over two pounds per 100 birds daily.

Feed no milk, use no lights.

Keep hard granite grit in hoppers.

Birds that fail to molt should be separated from the flock and subjected to a continuation of the molting schedule as given above until they begin to molt.

Past records of successful force molts show that the molting period requires from fifteen to twenty-three days, by which time production should not exceed 5 per cent. Feathers will usually start to drop ten to fifteen days after the mash and water are first removed.

During resting period: This period starts after feathers have dropped, and continues until the end of the sixth week.

Let birds out on clean range, and give all the green feed they will eat.

Feed three pounds of wheat bran or mill run daily per 100 birds. Be sure that all birds have a chance to eat at once. No bran should be fed until it is assured that a majority of the birds are molting.

Mix the equivalent of one pint of a good grade of cod liver oil or fish oil in each 100 pounds of scratch grain. The oil should be mixed each evening with the next day's scratch ration so that it will have a chance to soak into the grain overnight.

Continue three feeds of grain daily at the rate of eight or nine pounds per 100 hens. Increase the amount of grain if the hens are becoming thin. Decrease the amount of grain if the hens show a tendency to become overfat. Feed in a deep, clean litter.

Feed no milk, but keep clean fresh water before birds at all times.

Keep hard granite grit and shell in hoppers.

Use no lights.

During laying period: Seventh week until the end of profitable production.

Confine birds to laying house.

Either all-night lights or a fourteen-hour day may be used. In all-night lighting have one ten-watt light over each mash hopper and drinking fountain. It is not necessary to turn on all-night lights before 10 P.M.

Keep a good laying mash in the hoppers. Have twenty feet of eating space per 100 birds. Use a laying mash containing 1 per cent of biologically tested cod liver oil or fish oil or its equivalent in concentrated vitamin D.

Feed seven to nine pounds of grain per 100 birds daily, depending on appetite and weight of birds, one-fourth of the grain

mixture may be heavy oats. About 75 per cent of the grain should be fed at 3.30 P.M.

Provide adequate drinking space so that the hens do not crowd at the fountains.

In addition to the greens in the mash, feed four or five pounds of fresh green feed or crisp, yellow carrots daily per 100 birds.

Keep hard granite grit and oyster or clam shell in hoppers.

Have twenty to twenty-five nests for each 100 birds.

Cull birds that drop out of production each month. Rigid culling is desirable throughout the entire fall and winter months.

Egg production from a flock that has been forced to molt in the summer should not be expected to exceed an average of 45 to 60 per cent for the following six months.

"Black Leaf 40" for Sheep Parasites

Condensed from Sheep Breeder

IN a recent text form Australia, entitled, "The Internal Parasites and Parasitic Diseases of Sheep," by Dr. I. C. Ross and Dr. H. McL. Gordon, we found a combination of copper sulphate and nicotine sulphate ("Black Leaf 40") recommended as the preferred treatment for a number of internal parasites in sheep. The formula recommended was: Dissolve 1 pound copper sulphate in 6 U. S. Gallons of water; mix thoroughly with 16 fluid ounces of 40% nicotine sulphate ("Black Leaf 40").

The dose administered to sheep or lambs according to age follows:

Adults: 2 ounces.

Two-tooths, 12-18 months: 1½ ounces.

Lambs, 8-12 months: 1 ounce.

Lambs, 4-8 months: ¾ ounce.

Lambs under 4 months: ½ oz.

The treatment just described was recommended by these Australian authorities for the following internal parasites: Common tapeworms of sheep (*Moniezia expansa* and *Moniezia benedeni*); small intestinal worms (*Trichostrongylus spp.*); medium stomach or brown hair worm (*Ostertagia circumcincta*); twelve species of worms of the genus Cooperia, which occur in the small intestines of sheep; large stomach or wire worm (*Haemonchus contortus*).

Dr. Ross is a lecturer in veterinary parasitology in the University of Sydney and chief parasitologist of the Animal Health Laboratory of that institution. Dr. Gordon, co-author, is also connected with the Animal Health Laboratory and the Council for Industrial Research of the University of Sydney.

Reprinted by permission from the Sheep Breeder, Chicago, Ill.

Handling the Draft Stallion

Condensed from The Southern Planter

A Purebred draft stallion, owned by Chris C. Wedige, of Cuba City, Wisconsin, was bred to 209 mares in 1935 and 147 colts, foaled in 1936, were paid for. All were by natural service.

Wayne Dinsmore, Secretary of the Horse and Mule Association of America, says that so far as he knows this stallion holds the highest season's record in the United States for mares bred and colts foaled. He adds that an unusual feature of the case is that the horse was 12 years old.

The record, which has been verified by the Association, is as follows:

Age of Stallion	Year	Number of days horse was used	Number Mares Bred	Number colts foaled and paid for	Percentage colts paid for to mares bred
10	1933	120	138	91	65.94%
11	1934	130	157	105	66.87%
12	1935	170	209	147	70.33%
13	1936	160	177	Not yet known but approximately as high as ever	

Farmers will profit by knowing how Mr. Wedige has handled his stallion to maintain such high virility and fertility. Let Chris tell the story in his own words.

"I have been handling stallions on the stud for the past 46 years. I have stood 33 different horses, of both light and heavy breeds, and this horse, Major de Paul, a pure bred Belgian, is the surest stallion I have ever seen.

"I believe plenty of exercise, sunlight, good green grass, and enough clean grain and green cured hay, are the essentials in keeping stallions and mares in good breeding condition. I begin, early in the spring, to give my stallion about 4 miles active exercise daily. I ride, lead or drive him, and have him trot part of the time. During the breeding season heavy draft stallions are apt to get a little sluggish and unless they are compelled to travel actively at least four or five miles every day, they will not have enough exercise to keep their glands and organs in proper condition; hence I consider vigorous exercise and proper feed the two most important things in keeping a stallion in first class breeding

Reprinted by permission from the Southern Planter, Richmond, Virginia

condition, so virile that he will get 60 per cent or more of the mares bred, in foal.

"I truck him from mare to mare for breeding, as roads are hard, and distances long. I generally breed a mare in the morning and one in the evening, and let him rest at home during the day. As soon as green grass is available I hold him out to graze, or have it done, for a couple of hours in the morning and another hour in the afternoon, so that he gets at least 3 hours of sunshine and good grass every day.

"I feed bright green timothy hay with quite a little clover in it, and I want it very green and free from dust. I also feed a little choice alfalfa hay three or four times a week, using just enough of it to keep the kidneys and bowels in good shape. For grain I use crushed oats and bran and feed about 18 quarts of this mixture per day, during the breeding season. Major de Paul weighs about 2,000 pounds, but is an easy keeper even when on stud.

"I know most of the mares, owned by farmers in the adjoining counties. I know the breeding record of all the aged mares and I will not let my horse cover a non-breeder or one that looks like a non-breeder; furthermore, I will not breed a mare until she is in good physical condition.

"After the breeding season is over I feed less grain, a little more hay and turn Major de Paul out during the day in a pasture with a mare. This gives him exercise, sunlight and things to see and think about."

Mr. Wedige thus attributes the sureness of his stallion to good care, feed and common sense management the year around. The horse is an extremely prepotent breeder. Mr. Wedige says that he has never sired any colt except a roan colt, and guarantees any man who brings a mare, that the colt will be absolutely certain to be a roan. Color, however, is only one indication of his prepotency, as he transmits with equal certainty, the excellent set of legs, good feet, rugged, powerful muscled body, well proportioned shape and good quality that he himself possesses, to his colts.

New Trick in Apple Propagation

Condensed from Kansas Farmer

James Senter Brazelton

THE fact has long been known that apple cuttings will not take root. Consequently the propagation of apple trees these many years has been done by grafting the desired variety on seedling rootstocks. Now come certain scientists from the Bureau of Plant Industry, U. S. D. A., with the very important announcement that they have discovered a means by which apple trees may be propagated from stem cuttings. The new method, as announced by F. E. Gardner, in charge of nursery stock investigations is very simple.

According to Dr. Gardner the growing apple shoot is wrapped with black tape when leaf development starts in the spring. A 3-inch piece of tape will be long enough to wrap spirally around the young shoot 4 or five times, starting as near the growing tip as possible. Then when fall comes you take off the shoot, remove the tape and make a basal cut in the area that has been covered all summer and the cutting is ready to be set out. Root initials or points of origin form on the stem and promptly develop into roots.

With this new method of propagation comes a new word into our horticultural vocabulary; or at least it is new to most of us. The word is "etiolation," which, according to my dictionary, means, "to blanch or whiten by excluding the sunlight." The summer's growth of the twig is made entirely in the absence of light. Just why etiolation should be favorable to the production of roots on apple stem tissue, I think the scientists have so far not been able to explain. At any rate the new method will revolutionize things in the propagation end of the apple industry for it will eliminate the necessity of grafting.

Reprinted by permission from the Kansas Farmer, Topeka, Kansas, Feb. 25, 1939

Governmental Regulation of Agriculture in Russia

Condensed from Pennsylvania Farmer

S. W. Fletcher

IN the Russian Revolution of 1917, all private holdings of land, including the large estates possessed by the Church and the State, were expropriated. The Soviet government decreed, "The land owners' right of property in land is hereby abolished without compensation." The government became the sole land owner. The slogan was "All land to the peasants." The land was assigned to the peasant farmers in small holdings averaging about 15 acres each. This provided, it was thought, "equality of opportunity for all."

This scheme did not work. There was no incentive for the farmers to make their land produce abundantly, and the great problem of Russia is to produce more crops, not less. By 1921 the government found it necessary to permit some private ownership of land in order to stimulate production. This was a concession to individualism which immediately brought dire consequences from the communistic point of view. Naturally enough, some peasant farmers were more efficient than others. Gradually they acquired more land and became more prosperous than their neighbors. By 1927 these Kulaks, or better farmers, comprised ten per cent of the farmers, but cultivated 24 per cent of the land and produced 40 per cent of the grain. They began to show signs of an independent spirit and of pride of possession, both of which are inimical to communism.

So in 1928 the government "liquidated" the Kulaks. Many were killed, others were driven to concentration camps in Siberia, and the remainder were forced into collective farms. Five million farm people, including 1,000,000 of the most efficient farmers of Russia, were obliterated or dispossessed. The liquidation of the Kulaks is one of the most tragic events of Russian history.

In 1929, when the "Five-Year Plan" was launched, the government turned to compulsory large-scale, collective farming as a solution of the pressing national problem of food shortage. The 25,000,000 small peasant farms were abolished as production units.

Reprinted by permission from the Pennsylvania Farmer, Pittsburgh, Pa., Feb. 11, 1939

The economic advantage of large-scale operations in agriculture, as in industry, is one of the central tenets of the Marxian philosophy on which communism is based. It was made more plausible in Russia by the admitted inefficiency of the very small peasant farms with their unavoidable dependence on hand labor.

Large-scale farming in Russia is of two types—state farms and collective farms.

State Farms are very large farms owned and operated by the government. State farms were established from the beginning of the "Dictatorship of the Proletariat" in 1918. By 1928 there were 6,000 such farms, comprising 9,000,000 acres. Their size ranged from 250 to 5,000 acres. In 1929 it was decreed that 15,000,000 acres more should be added to the State farms, and their average size increased to 95,000 acres. Many comprised over 200,000 acres each. Since these farms were to be devoted primarily to the production of wheat, they were called, very appropriately, "grain factories." In America we would call this "factory farming." By 1932 the State farms comprised 37,000,000 acres.

The confidence of the Soviet government in the superior efficiency of large-scale farming has been severely shaken by the evidence of the past ten years. The most serious shortcoming has been long range bureaucratic control, resulting in higher overhead. The central government assumes the responsibility for making all decisions, even on minor problems; it buys the seed and fertilizer, and determines when to sow and harvest. It operates all the farms on a standardized plan without full consideration of the varying local conditions of soil and climate.

The results were disastrous. Close supervision from one governmental center froze the initiative of the farm managers. The workers had little incentive to labor—they are working for the government. Large-scale farming necessitates extensive use of machinery—tractors, combines, trucks. Russian farmers, accustomed for centuries to tilling the soil with hand and horse-drawn implements only, are not machine-minded. They do not fit readily into mechanized agriculture, which is the goal of the Soviet program. Crop losses due to inefficient use of machinery have been very heavy.

The inefficiency of State farms was so obvious that in 1933 it was decreed—note the implications in the word "decreed"—that their maximum size should be 140,000 acres and that each farm should be divided into production units of 14,000 to 17,000 acres, each unit being in charge of a

sub-manager. Financing, planning and machinery, however, continued to be centralized for the entire farm. It was decreed, also, that single crop farming should be abandoned and diversified farming begun.

The Soviet government needed very urgently more grain to feed its industrial workers. For a number of years over 90 per cent of the land of State farms was in grain continuously. But dwindling yields forced the government to introduce both crop rotations and the keeping of livestock. In 1933 Stalin himself admitted: "Our State grain farms are too large and unwieldy, too specialized. They have no crop rotations or no livestock breeding. It is obviously necessary to divide them and to discontinue their undue specialization."

In 1935, therefore, the State farms were reduced to a maximum of 75,000 acres each, and diversification began. Bonuses of various kinds were paid for superior achievement. The most significant concession of all was that married workers on State farms, who heretofore had been living in dormitories and eating in communal dining halls, were allowed to have separate homes. Each family was permitted to till a small tract of land and keep a few cows, pigs and chickens. Thus collectivism was forced to compromise with the individualism which is inherent and eternal in all races and all nations.

Notwithstanding these concessions and improvements, the State farms have been a dismal failure. They operate at a loss. Yields are low in spite of the governmental fiat of 1936: "We must compel our State farms to yield more abundant crops." Since 1935, the area in State farms has been reduced more than 25 per cent, and the shrinkage continues at an accelerated pace. The Soviet government is now shifting its attack to a new front—collective farms.

In the "planned agricultural economy" of the Soviet government the State farms were expected to prove that large scale industry and large-scale agriculture follow the same pattern, as to the economies that may be effected by mass production—the larger the farm the lower the cost of production. This theory has not been substantiated.

The collective farms differ from State farms, which are operated by the government itself, in that they are, theoretically at least, a form of producers' co-operative. Since 1929, more than 18,000,000 small peasant farms, averaging about 15 acres each, have been combined into 250,000 collective farms. These so-called "co-operatives," however, were not organized by the farmers voluntarily but under governmental compulsion. Collective farms now repre-

sent about 80 per cent of Russian agriculture. They vary in size from 250 to 40,000 acres each.

There is complete collectivization of land, livestock, implements, management and financing. Since 1934, however, each member farmer has been allowed to possess a home and the use of a small plot of land around it. together with livestock for family use. Some collective farms allow as much as 20 acres for each member capable of working it, others less than five acres. This homestead, however, remains the property of the State.

A collective farm is a co-operative in name only. The farmers are bound as tightly as those who work on the State farms. The government, not the local farmers, plans the cropping system, buys the seed and fertilizer, fixes prices and controls sales. It imposes upon each collective farm a heavy annual levy of "tax in kind," that is, a percentage of all crops or livestock produced to the government. What is left may be distributed to the members of the pseudo-co-operative.

The agricultural economy of communistic Russia is based on mechanized farming. All the machinery on collective and State farms is owned by the government. Scattered over the country are "machine tractor stations" having in their charge many thousands of tractors, combines, trucks and other machinery. This equipment is put to work where needed and the farms are charged for the service. Nearly seven per cent of the grain threshed by these stations and nine per cent of the grain harvested with their combines is paid to the government. Each machine-tractor station has a police department which is the "party eye" of the government in controlling agriculture. Punishment by death or banishment to a concentration camp is meted out to those who violate the regulations set up by the government for the operation of State or collective farms. Every now and then there is a "purge" of administrative personnel, including officials of the Commissariat of Agriculture.

It is difficult to appraise at this time the gigantic social and economic experiment now in progress in Russia. All the evidence available thus far, however, points to the failure of socialized farming. The State farms have been a colossal failure. The collective farms have made a better showing, but even here the yields have been below pre-Revolution figures, and the government has been obliged to make numerous concessions to individualism. The trend is definitely toward more and still more freedom of initiative for the individual, as a matter of necessity.

Collectivization, however, has

some achievements to its credit. It has done away with the inefficient "strip farming" of peasant farms, which featured Russian agriculture before 1917. It has stimulated the application of the sciences to agriculture; some of the best soil research in the world now is coming out of Russia. It has developed a successful program of crop insurance. But these assets are greatly overbalanced by the social liabilities—a lower standard of living, loss of personal liberty, the stifling of religion, and the paralyzing effect of governmental compulsion and regulation in all aspects of life.

There are no free and independent farmers in Russia; there can be none under the present regime. There are 30,000,000 infinitesimal cogs in a gigantic political machine.

Humus and Mineral Fertilizers

Mineral fertilizers supplement, but in no way do they replace humus. Recent experiments have proved that mineral fertilizers are much more effective if they are applied either with, or immediately following an application of humus than if they are applied alone. At the Maryland Experiment Station crop yields have shown an increase varying from ⅕ to ⅓ more when manure and mineral fertilizers were applied together than when double the amount was applied alone.

New Way To Put Up Hay

Condensed from Capper's Farmer

Arnold G. Maupin

THE covered wagon has been outmoded as a vehicle for transcontinental travel, but it is the newest thing in the hay field. It comes as a companion of the field chopper with pickup attachment that gathers hay from the windrow and chops it at the rate of 2,700 pounds in 7 minutes. The time given is that actually consumed in putting on a load after the tractor is started. A four man crew and a machine averaged about 6 tons an hour thru a working day on the Beedy Brothers farm in Kankakee county, Illinois, last summer.

Hay is mowed and windrowed with a side delivery rake as soon as it wilts. It cures in the windrow and no leaves are lost. When dry enough to store, it is picked up, chopped and loaded at one operation. The tractor pulls both the chopper and rubber mounted wagon, and supplies power thru a take-off shaft to operate the cutter.

The Beedys use three of the covered wagons. As soon as one is filled, a pickup truck hauls it to a blower that puts it into the mow. An empty wagon is hooked to the cutter and is filled by the time the truck returns. When the truck reaches the barn it picks up the empty wagon there and returns it to the field. Thus one of the three wagons always is at the chopper, one at the barn and one on the road. With pneumatic tires, the trucks may be pushed around by hand, empty or loaded.

The blower at the barn is of a type that may be used to elevate either hay or threshed grain. It has a hopper that may be stood on end while a load is pulled into place, after which it may be let down to a horizontal position. The chopped hay then is raked out of the rear end of the covered wagon by two men with forks, the tines of which are bent to an angle perpendicular to the direction of the handle. A reel at the throat of the blower revolves so that the bottom throws back hay when it comes in quantities too great for the blower. That admits hay to the blower fan at an even rate and men who unload need not exercise especial care to keep from choking it down.

This blower, and that on the cutter, aid materially in the drying process, and hay may be chopped and stored before it is dry enough to keep in the bale.

Reprinted by permission from Cappers Farmer, Topeka, Kansas, Feb., 1939

That cuts the time between mowing and storage and reduces the risk of wet weather damage. Salt is mixed with the chopped hay at the rate of 12 to 15 pounds a ton. It aids in the curing process and lessons the spoilage risk when hay a bit high in moisture is stored.

"Chopped hay is economical because twice as much can be stored in a given space," Howard Beedy said. "That, however, was not the only consideration. It was difficult to get help, and we like this method because it enables us to put up hay twice as fast with a crew half as large as would be needed for other methods that would be practical on this farm. We run a large dairy herd, operate five milk routes, and bottle 1,700 quarts of milk and a lot of cream each day. It takes considerable feed to produce so much milk, and we keep 80 of the 640 acres in alfalfa. It would require a big labor bill to handle three cuttings a year in the old way, and we would lose more hay. This way materially reduces weather loss and practically eliminates loss of leaves.

"We have grown, in addition to alfalfa, as high as 60 acres of soybeans for hay. They are hard to handle as loose hay, and cattle have a tendency to pick out leaves and pods and leave stems in the manger. When beans are chopped everything is consumed.

"Blowing chopped feed into the mow eliminates haymaking's hottest task. We set the pipe to blow high, hay falling bit by bit over a wide area packs closely, and no one is needed to work in the mow."

The blower of the portable cutter enters the front of the wagon close to the top. The rounded top and sloping sides of the enclosure make it possible to fill the wagon from top to bottom with the exception of a small space near the end of the blower. Slope of the sides and a floor width the same as that of the rear door make it easy to rake off the load.

The Redwoods of California

Condensed from Armour

PROBABLY no other wood is as versatile as Redwood. It has size and strength and durability which fits it for any kind of outdoor construction. It has grain and texture and beauty which makes it suitable for the furniture and inside finish of the finest homes. Its bark is made into efficient insulating material and its sawdust makes an excellent fuel.

The idea of cutting down the California Redwoods to make lumber and fuel, using nature's oldest living handiworks for utilitarian purposes, may seem abhorent to the nature lover but there is no reason for resentment. There will be Redwood forests of magnificent trees for our children and our children's children.

The Redwood belt of California, lying roughly from about 20 miles north of San Francisco up across the Oregon line and for a distance of 30 miles in from the coast, is divided into two distinct classifications—recreational areas and commercial. The recreational area is the territory which has been set aside for park and recreational purposes. These are large forests in accessible places, mostly along what is known as the Redwood Highway.

Despite all of the logging which has been going on for years and years in the Redwood belt, there is still approximately 55 billion feet of virgin Redwood timber still standing. Experts say that if all the sawmills in the United States were to work at full capacity on the present supply of timber, the Redwood mills would be operating at full capacity in virgin timber fifty years after all other species of softwoods were exhausted.

Standing virgin timber will last 75 to 100 years, after which second growth trees, now 50 years old, will provide timber for 25 to 50 years. The trees planted today will serve for lumber, thenceforth assuring future generations of ample supplies of the coveted Redwood.

Of course it is necessary to give attention to the replanting of the trees. Nature perpetuates the Red Wood with "suckers" (new growths which it sends up from the stumps and roots) as well as the seeds; thus the forests are fairly well maintained. Seed trees are left in all cut-over lands to facilitate this natural reproduction and nurseries are maintained for the raising of millions of seedlings which are planted at regular intervals in cut-over soil.

Reprinted by permission from Armour, Union Stock Yards, Chicago, Ill., Feb., 1939

Specimens of Redwood trees, one, two and even three thousand years old are found throughout the million acres of unharvested Redwood forests. Trees, ten, fifteen and even twenty feet in diameter are cut by trained crews of woodsmen who know how to fell them so as to avert breakage. Specially designed engines, cars and equipment have been invented to handle the great trunks. They are sent to saw mills where powerful machinery runs them through hugh saws that cut from the ponderous logs fine, clear, unblemished lumber in lengths and widths limited only by the needs of the consumer.

In discussions of Redwoods, or other lumber areas for that matter, the associated thoughts are usually of how the logging is carried on, the cutting up of the wood into usable lumber, etc. But beyond this stage there is much of interest. To what great variety of uses is the finished Redwood put, and why is it one of the most highly prized woods in the world?

One answer to the latter is probably because of its outstanding durability, its amazing longevity and its resistance to fungus, insects and decay. Every cell of the tree contains a chemical deposited there by nature during the life of the tree. It remains in the wood indefinitely, protecting it while living and after death. An example of this would be a 600-year-old fallen Redwood tree discovered deep in moss and debris and overgrown by a 400-year-old tree, and still sound and solid to the core. Wood exposed to the elements for four centuries and still found to be in perfect condition must have qualities which would make it of outstanding use to millions.

Redwood, to the average layman, is probably pictured in the interior of a home. Its use for paneled walls imports distinction to the furnishings and provides a beautiful, subdued, restful background of richness and quality. Hand hewn beams across ceilings give character and personality to distinctive rooms. It is unnecesssary to stain or color Redwood, although it takes and holds any desired finish. Beautiful combinations of greys and browns are secured by applying a light stain and rubbing while still wet to remove enough to bring out the highlights and the grain. Its natural color is rather difficult to describe—silver browns, greys, and reds imbedded with a warm mellow glow would probably give you a mental picture of its appearance. The color itself is easily protected and preserved by the use of a plain white wax, well rubbed, either with or without a colorless "filler" applied first; or by such a filler followed by a good varnish, dull or other-

wise. These are only two of the many "natural" finishes which have been successfully used.

Lack of pitch gives the Redwood another notch in its belt of advantages—it aids in the prevention of fire. The wood contains no pitch and no oils that feed flames. It burns slowly and indifferently when exposed to fire, but will not spring into flame and burn progressively. After the small kindling has been consumed the fire quietly burns out. During the fire of 1906 in San Francisco many Redwood houses served as firebreaks and immediately following the fire, orders were given regarding the character of building material to be permitted in the work of reconstruction and one of the orders read that "owners of property will be allowed to proceed and erect one-story buildings of Redwood without a permit."

The American home maker and business man, however, are not the only ones to put Redwood to great tests each day in the general routine of living. Practically every civilized country of the world has examples of the outstanding enduring properties of Redwood. In the jungle swamps of Sumatra where climatic conditions are especially favorable to decay and insects, oil companies have erected offices and homes of American Redwood which have withstood the onslaught of such normal enemies of woods. Central American countries with their tropical climates and destructive termites use Redwood in construction of buildings for their banana and coffee plantations. South Africa uses Redwood for the construction of cooling towers, mine shafts, wooden tanks and pipes. Greenland has its share of the Redwoods done up in boats. Europe puts it to use in high class interior work and for tanks required by the brewing and distilling industries. Its warp resistance attributes make it invaluable in tanks of this sort. Farm silos are made of it for the same reason. Peru has its network of railroad ties of Redwood because of its resistance to climatic and soil deterioration as well as termite attack.

For any type of construction that is much exposed to the elements, such as bridges (some of which have been up for 50 and 60 years in California and are today still carrying traffic), culverts, telephone poles and railroad ties, where water and earth conspire to produce decay, Redwood is efficient.

Because of its tonal qualities Redwood is used for veneer cores, piano cases, wind chests and pipes of organs as well as violins and harps; its peculiarly uniform cellular structure makes a Redwood box a natural humidor, conse-

quently many cigar boxes are made from it. The color is comparable to that of Spanish Cedar making it unnecessary to stain or veneer it and is entirely free of taste or smell.

Incubators; ice cream cabinets; clothing chests; etc., are made of the clear lumber. Its immunity to decay and rot, its insulating properties, and because it is so easily moulded and worked into various shapes, makes it ideal for the above and many other widely diversified products.

For years the rugged protective bark of the world's oldest living trees, often 12 inches thick, almost impossible to burn and practically immune to rot and decay, has offered a knotty disposal problem to the producers.

After years of research The Pacific Lumber Company discovered the answer. The wiry fibres in Redwood bark had all the inherent properties for ideal insulation! Odorproof and extremely light in weight, this new product of the forest known as Palco Wool seems to have everything desirable for ideal insulation and is being successfully used both for cold storage and domestic insulation throughout the United States.

All things considered, the Redwoods of California are one of Nature's best gifts to man.

Home-Grown Power

Condensed from The Nebraska Farmer

Ross H. Miller

Animal Husbandry Dept., Nebraska College of Agriculture

THERE are only two ultimate consumers of agricultural products, man and horse. Other farm animals that live on agricultural products are food factories; the feed they consume is used to produce meat, wool, butter, eggs, etc., for human consumption.

It has been estimated that man requires the produce from two acres and that the crops from four acres of average cornbelt land are required to maintain a horse for one year. Unfortunately there were 165,000 fewer horses and mules in Nebraska January 1, 1938, than on January 1, 1934. For each horse or mule that is replaced by some other power unit means that the crops from four acres of land must be marketed through some new outlet. Thus we can readily see that in 1938 the crops from some 666,000 acres of Nebraska farm land, which were used to produce farm power prior to 1934, have been shifted into some other channel.

Horses and mules live upon farm-produced feeds, the same as do other kinds of livestock, but instead of turning these feeds into meat, wool, milk, butter, etc., they convert the roughage and grains into drawbar power.

A good pair of brood mares is capable of raising about three colts every two years. Since six good work horses are capable of taking care of the drawbar power on the average 200-acre cornbelt farm, it can readily be seen that in four years' time a pair of good work mares is capable of producing sufficient work-horse replacements for the average farm. Outside of a 10-day period after foaling, these mares can take their regular turn in the field, on the feed wagon, or at other farm jobs, thereby paying for their feed and care.

It would be fallacy for the average farmer or rancher to start a commercial horse production program, but the farmer who will raise a few colts from his best work mares each year will at least be raising his own farm power replacements and thus be in position to cash some of his older horses from time to time as the horse market looks right.

Reprinted by permission from the Nebraska Farmer

Farmers who will accept such a program naturally should try to raise the right type of horse or work mule that will meet the present-day market demand, as well as prove to be a satisfactory power unit on the average corn-belt farm. The big draft horse and mule used in the city to move heavy loads have been replaced by trucks. The present-day demand for work stock is largely in the country, therefore the type of horse and mule that sells most readily at the present time is considerably different in type than the work animal that proved to be desirable for heavy dray jobs in the cities.

In a recent survey made by the Horse and Mule Association of America covering typical horse and mule owners in 12 Midwestern states, it was learned that the majority of the farmers seemed to prefer work horses and mules that are of medium size, standing 15 hands (60 inches) to 16 hands (64 inches) in height and that are set right on their legs, have a good fast walk, are alert, and are able to endure hard work in hot weather. This horse should weigh in the neighborhood of 1,400 to 1,550 pounds. Leggy, upstanding horses are very undesirable as are the short, pudgy kind that are not able to do their work at a reasonably fast walk. A model horse of today should be high-headed, with an alert eye and ear, and should have a medium-length neck that blends smoothly into sloping shoulders. His withers should be smooth and distinct, a short strong back and a short coupling that is heavily muscled is very essential. Our present-day horse should have a heavily muscled croup that is nearly level, and in fact, must show draftiness and muscling throughout the entire body.

The past few drouth years have taught us the necessity of having a horse that is capable of doing relatively hard work while being fed rations made up largely of roughage with the minimum amount of grain. The round, deep-ribbed, short-coupled horse will always stay in better condition than the loosely built, shallow-bodied horse.

The work horse of today must stand on a good set of feet and legs. Farmers throughout the country realize the importance of having a horse that shows a great deal of quality in his underpinning. Both fore and hind legs should set squarely under the horse and be reasonably straight. The foot should be round and deep, the pastern reasonably long and sloping, the cannon bones flat, and the hock and knee joints fairly large and clean.

If farmers are to improve the quality of their work stock it is of paramount importance that they breed their mares to the

right kind of a stallion. There is a large variation in the type and conformation of brood mares and unless mares are bred to desirable stallions it will be impossible to produce a uniform type of work horse that will meet the market demand of the southern and eastern buyer. The stallion of medium type that shows plenty of draftiness, a good middle, and the right kind of underpinning, should be selected for breeding purposes. He should weigh in the neighborhood of 1,900 pounds as a mature horse in breeding condition. The breed is not so important. There are good ones in every breed but the type and breeding qualities of the horse, in other words, his ability to transmit his desirable characteristics to his colts is the most important factor to be conisdered.

In a recent study completed by the Percheron Association of America in which 12 of the best horse judges in America selected the 10 best stallions and 10 best mares from a group of 46 of the leading Percheron show stallions and 45 of the leading show mares, it was found that the average height of the 10 leading stallions was 16 hands 2⅔ inches, and the average weight 2,166 pounds. The leading stallion was Enchanter, a Nebraska horse bred by the late T. B. Bowman, of Boone, Nebraska. In his 4-year-old form Enchanter stood 16 hands, 2½ inches (66½ inches) high and weighed 2,050 pounds in show condition.

Good livestock farmers who will plan their operations carefully, feed their horses and mules efficiently and give these animals reasonably good care not only will derive a great deal of pleasure from producing and working good horses and mules but are also able to maintain a constant yet flexible farm power unit with practically no cash outlay.

Treating Farm Canvas

Condensed from The Ohio Farmer

George J. Thiessen

CANVAS covers rot instead of wearing out on most farms. They cost real money— but are not given the necessary care to preserve them. With little expense and time, double wear can frequently be obtained. A leaky covering over an expensive machine does little to protect it from the elements.

There are many so-called water-proofings that can be made at home. Some are good but others are worthless. Unless you know positively one of these solutions has proven good, it is best not to run any risk but purchase the needed waterproofing. It can be purchased in paste form, then gasoline and coal oil added in proper amounts, so the gallon costs only about 75 cents. Most home-made mixtures are more expensive.

Many have tried melting paraffin and applying it. This hardens and breaks. It also is more expensive than the paste waterproofings which can be mixed at home. In handling these, each can makes a gallon which will cover from one hundred to one hundred and fifty square feet. In general, it is best to figure about a hundred square feet for a gallon of waterproofing, for, when applied heavily, the treatment lasts longer. Much depends of course upon the use to which the duck is put. If you have a stack cover which will remain outdoors for months, a heavy application is desirable, where on the other hand a tent that is used only for camping a few weeks out of the year need not be given so much waterproofing.

In handling the paste waterproofings, it is best to obtain a large can or pail. Heat the mixture until melted, then slowly add the solvents, gasoline and coal oil, stirring well with a wooden paddle. Add the solvents outdoors to eliminate all danger of fire.

Stretch the canvas tightly on the grass or a barn floor. Then use a stiff broom and thoroly sweep the cloth. Next apply the mixture and while there is no particular harm in putting it on the inside of the canvas—that is, the side not exposed to the weather —it is better to apply the mixture to the outside. It is not necessary to cover both inside and outside for if the waterproofing is good, it will permeate all the fibres. It

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is best to do the work on a hot day and if the mixture is warm it seems to penetrate better.

Proper treatment of farm canvases prevents mildew, rotting, etc. If your coverings are rotten or badly deteriorated, do not expect any waterproofing to make them new. On the other hand, unless the fabric is very poor, the waterproofing will arrest the deterioration.

Friction is an enemy of duck, particularly the large, heavy covers. Do not drag them on the ground more than necessary. In arranging a canvas over a stack, machinery, etc., take special pains to fasten it securely so that the wind does not whip it about continually. When the fabric is constantly blown up and down, against what it covers, friction soon wears it out.

The higher priced ready-to-use waterproofings are good also. They, like the paste preparations, are made with waxes, etc., and about the only difference is that solvents have already been added.

Wet or frozen canvas should never be folded and put away. If one gives the average covering reasonable care and waterproofs it occasionally, it should last for years. On the other hand, the best material manufactured, if neglected, will soon be worthless.

How to Save Girdled Apple Trees

Condensed from American Agriculturist

W. H. Thies

Extension Horticulturist, Massachusetts State College of Agriculture

FINDING a few hundred girdled trees after the snow melts in spring is disconcerting to say the least; yet that was the experience of several New England growers last spring. In one case 700 fine, thrifty apple trees were more or less completely girdled below the ground level. Fortunately, the owner observed the damage at once, and within a month had done a thorough job of salvaging the damaged trees. While prevention of girdling is better than a cure, salvage operations are entirely practical and many a valuable apple tree is today bearing a heavy crop of fruit because someone was interested enough to insert a few bridge grafts in a girdled trunk in years past.

An apple tree may be almost entirely girdled during the dormant season and yet show little evidence until the second season. Then its leaves begin to look yellowish and it takes on a decidedly unhealthy appearance. When this stage is reached, repair of the damage is difficult, if not impossible. The ideal time to bridge graft is in the spring immediately following the removal of the bark.

If all of the girdling caused by mice were above the ground level, detection would be easy. But often the bark is gnawed below that level, and the damage is not noticed without digging away the soil around the trunk.

Mice seem to show litle respect for age in trees. They have been guilty of destroying trees in the nursery, as well as trees 80 years of age. They are also rather impartial as to the kind of fruit. By far the most damage occurs in apple and pear orchards, although peaches, plums and other tree fruits may be attacked if they happen to be in close proximity to the mouse runs. In the case of stone fruits, bridge grafting is seldom practiced. With apples and pears, bridging is not recommended on trees less than an inch or two in diameter. Not only are the bridges difficult to place successfully in such trees but there is less loss of time involved in replanting. The length of the injured area is also a factor. If,

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for example, the trunk of a two-year-old tree is girdled to a height of two feet, we have not only a long expanse of wood to bridge, but there is danger of the slender cylinder of sapwood drying out before new channels can be established.

The required equipment and materials are few and simple. Trees have been successfully bridge grafted using nothing but a jackknife and suitable scion material. To do a first class job, however, one should also have a supply of small, flat headed nails (about 20 gauge), a hammer, some good grafting wax, preferably home-made, and, needless to say, a shovel or hoe for removing the soil around the tree. In selecting scions for bridge grafting, it is well to choose flexible, well matured growths, such as water sprouts. Ordinarily, these should not exceed half an inch in diameter at the thickest end. Where the area to be bridged is limited, it is sometimes convenient to use terminal growths from the tree itself.

In one satisfactory method of bridge grafting a tree, notches are made in the live bark above and below the wound, of a width corresponding to the thickness of the scion. These notches are rectangular in shape and about two inches in length. The scion is next measured and cut slightly longer than the distance between the ends of the two notches in order that it may bow slightly and fit firmly against the bark. A slice at least an inch long is then cut from each end of the scion, extending somewhat into the sapwood. The bridge is then placed in position and nailed, using one nail at either end.

Similar notches are then cut in the bark around the trunk at intervals of from 2½ to 3 inches. Thus a completely girdled tree whose trunk is 18 inches in circumference will require at least six bridges. It is always advisable to place the bridges a little closer than seems absolutely necessary, in order to allow for an occasional bridge which is accidentally removed or for some reason fails to establish union with the tree. After all of the scions are in place they should be carefully waxed. Either hand wax or brush wax may be used. If the former, a lump of wax about the size of a hickory nut is sufficient for each end. Some growers wax only the upper end depending upon the moist soil with which the scions are later buried, to keep them from drying out. As a matter of insurance, it seems advisable to wax both ends. In either case, intimate contact between scion and trunk is absolutely essential. If the girdled area is almost entirely below the surface of the ground, there is less need for protecting the exposed sapwood. Where the

injury extends upward on the trunk, however, it is well to paint exposed wood with material such as melted grafting wax or white lead to prevent its drying out.

The method described above may be likened to a piece of fine cabinet work since it involves a careful fitting of the scions into the notches.

Another method involves trimming the edges of the injured area back far enough to reach active tissue, and then merely making vertical incisions at intervals to permit pressing the ends of the scion under the bark for a distance of at least 1½ inches. Nailing should be done as in the other methods. I prefer the first method, even though it requires a little more time. If carefully done, there is no reason for losing more than one scion in ten.

It is impossible to predict the amount of damage which mice will do from year to year; they have a habit of attacking trees when we are least prepared. The season of 1937 was particularly severe in Massachusetts from the standpoint of mouse injury. Investigations show that the mouse population in some orchards may exceed 100 or more mice per acre. Authorities in the Biological Survey report as many as 300 mice per acre where feeding conditions are highly favorable. All things considered the apple grower of the Northeast should take stock of the situation at least twice a year, once in the fall when poison bait is normally exposed, and again in the spring to determine the extent of damage done during the dormant season.

Grass Plus Grain for Poultry

Condensed from Successful Farming

Loyal F. Payne

Kansas State College

SUCCESSFUL poultry-growers are becoming increasingly interested in feeding large quantities of finely chopped grass to growing chicks. Where this practice has been followed consistently, many interesting results have been observed. The chicks appear unusually healthy, with but little or no mortality; shanks and beaks take on a rich yellow color; and growth up to 10 to 12 weeks is usually 25 to 30 percent above normal.

Pullets that are receiving all the grass they will consume during the growing period seem to have considerable resistance against the ravages of roundworms and tapeworms. That is, heavy egg production is frequently obtained even with fairly heavy infestations of internal parasites. While the high summer temperatures in certain sections of the Midwest the past few summers retarded mid-season growth, the recuperative power of pullets during the early fall months has been remarkable on those farms where succulent green feed has been available thruout the growth period.

Poultry-producers who have come to realize thru experience that certain grasses possess peculiar nutritive qualities for growing chicks and laying hens, make it a point to provide this material in some form thruout the year. Spring seedings of oats are ready for the early chicks from April to June. This is followed with Sudan Grass which, if cut every week or two, remains tender and palatable thruout the summer or until early fall oat, wheat, or rye pasture is available.

The soiling method of feeding is most satisfactory. When the chicks are a week old, one should begin feeding some of the tender spring grasses—oats being preferred. The oats can be pulled or cut with a reap hook, then cut into short pieces with shears or a feed-chopper. It should be fed liberally once or twice daily. Small chicks will eat large quantities of this material, even tho mash and grain are before them continually. Incidentally, this will reduce the amount of grain required, which is an important factor in lowering the cost of production.

Reprinted by permission from Successful Farming, Des Moines, Iowa

Tender, tame grasses (including oats, wheat, rye, barley, and Sudan) are peculiarly adapted for growing chicks and laying hens, as they are high in protein and low in crude fiber. Most commercial protein concentrates are high in price, hence are too often neglected in the poultry ration of farm flocks.

Dehydrated oat-grass meal may be regarded as a protein concentrate. In fact, it has about the same nutritive ratio as linseed meal. It is also rich in Vitamin A. A sample tested at Kansas State College recently, contained 28.5 percent protein and 310,000 units of Vitamin A per pound. An equal amount of yellow Southern corn contained about 6,350 units of this vitamin. A Canadian worker reports that grass ash contains about 15 minerals, including copper, iron, and manganese, essential for building blood. These and other elements apparently give the grasses a peculiar nutritive value for poultry not generally appreciated as yet.

Scientists in Europe have been studying the value of grasses in dairy rations since 1925. They have considered time and frequency of cutting, composition, methods of preservation, and nutritive value when tested biologically with sheep and dairy cows.

Dehydrated grass and grass silage were found to be highly digestible, and they increased the color and Vitamin A in the milk equal to that obtained when cows were turned on spring pasture. German workers reported that acid silage, when fed to hens at the rate of 1.6 ounces per bird daily, reduced grain consumption 20 percent and resulted in much utilization of the feed.

Green oat-plant silage has been fed to the laying flocks at Kansas State College for three winters. The feed, when stored in pit silos, retained its green color and most of its Vitamin-A content. It was palatable and imparted a rich golden color to the egg yolks. The question confronting poultrymen at present is whether the dehydrated grasses compare favorably with the ensiled grasses. Further experimental work will be necessary to settle this point. Stored grass silage, using acid or molasses in pit silos, may in the future become a common source of green succulent feed during the winter months. In the meantime, poultrymen will do well to supplement high-priced grain with early-sown oats prepared and fed as suggested above. The value in the oats is in the blades and not in the stocks. Oat grass is of little value after it reaches the jointing stage. A continuous spring supply can be had by sowing patches convenient to the brooder houses every two weeks,

until Sudan Grass is large enough to feed.

Poultrymen who are grass-minded this year will not only be able to reduce their grain bill, but they will also be most favorably impressed with the healthy, vigorous chicks produced. The laying flock will also respond satisfactorily to the grass diet as a supplement to mash and grain rations.

Fertilizer Trends

MOST fertilizers sold in Alabama for general crops carry limestone as a filler instead of sand. The fertilizers carrying limestone are labeled "non-acid forming" while those carrying sand are labeled "acid forming." This has been the practice for the past three years and has proved very popular with farmers in the state.

The Alabama Experiment Station proved that it would be profitable to farmers for limestone to be used as a filler instead of sand. The results were then reported to fertilizer manufacturers and dealers who agreed to co-operate with the Experiment Station and Department of Agriculture in seeing that this was done.

Dean Funchess, of the School of Agriculture, says that this practice alone is saving Alabama farmers from paying about $156,000 per year for sand in their fertilizers and should increase the cotton yield about 50 pounds per acre on 3,000,000 acres of acid soil in the state. This increased production should have a total annual value of about $4,500,000.

Upon recommendations of the Alabama Experiment Station, and Extension Service, Alabama farmers are fertilizing most of cotton with 6-8-4 or with 3-8-5, and are side-dressing with a nitrogen fertilizer. In 1935 the station recommended 600 pounds of 6-8-4 or its equivalent per acre. About 10,000 tons of this grade were used that year. Seeing the excellent results, farmers of the state increased this tonnage to over 90,000 tons in 1936 and to 181,040 tons in 1937. Many farmers who did not use 6-8-4 purchased 3-8-5, and side-dressed with a nitrogen fertilizer.—*L. O. Brackeen, Alabama, Southern Agriculturist*

Side-dressing Cotton and Corn

Condensed from Southern Agriculturalist

J. E. Stanford

FOR the past 25 years or more Southern experiment stations have conducted thousands of tests in an effort to determine the proper mixtures, rates of application and methods of applying fertilizers to field crops, especially cotton and corn.

It is interesting to note the general agreement on the amount of plant food recommended for these crops. For cotton on upland soils mixtures carrying approximately 36 pounds of nitrogen, 48 to 60 pounds of phosphoric acid (P_2O_5) and 24 to 48 pounds of potash (K_2O) are generally recommended. The phosphate and potash requirements may vary depending on whether soil is of clay or sandy texture. The need for a liberal application of nitrogen so essential for high yields and economic production is evident.

The efficient use by the cotton crop of any fertilizer mixture or material depends largely on the time and method of application. This is particularly true of readily available nitrogen sources used for side-dressing. Throughout the cotton belt it has been the long-time experience of thousands of practical farmers that it is much safer year in and year out to apply only ¼ to ⅓ of total nitrogen to cotton before planting, withholding the remainder for a side-dressing to be applied after the cotton is chopped and just ahead of squaring. These farmers have learned that it is better to wait until the cotton is up to a good stand, chopped out and cultivated once before applying the major portion of the nitrogen. At this stage of growth the cotton plant has developed a good root system and can take up the readily available nitrogen quickly, when if all the nitrogen is applied before planting weather conditions may be such as to promote the growth of weeds and grass at the expense of the young cotton. Plants foul with weeds and grass increase chopping costs and destroy the stand.

Throughout the old cotton belt where cotton has been fertilized before planting with low-nitrogen mixtures such as 3-8-5, 3-8-3, 4-8-4, 4-10-7, 3-9-5, 4-8-6 and 3-9-3 it is advisable to side-dress with sufficient nitrate of soda to bring the total nitrogen application up to 36 pounds per acre. At this time more potash can be added along with the nitrogen

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side-dressing, if need for additional potash is indicated.

Several experiment stations have published results of tests which support the farmers' practical experience and observation. The Alabama Station reports from a Chilean Nitrate Research Fellowship conducted in 1924 to study rate of absorption of nitrate of soda by cotton and oats when applied at different stages of plant growth. The results show that when nitrate of soda was applied to cotton 14, 40 and 61 days after planting absorption was complete in 36, 14 and 11 days, respectively. When the application of nitrate of soda is delayed until a root system is developed the crop will absorb the nitrate rapidly. The later the application and the larger the root system the more rapid the absorption. Other Alabama tests show, however, that the greatest increase in yield from a nitrate of soda side-dressing comes from the application when the plants are about 40 days old, that is after chopping and just ahead of squaring.

In 1928 the South Carolina Experiment Station also conducted tests on a Chilean Nitrate Research Fellowship to study time and rate of application of nitrate of soda to cotton, corn and oats. The results with cotton are in agreement with the Alabama data. The South Carolina Station concludes that "where an application of 200 pounds of nitrate of soda was made to cotton at different stages of growth, the highest yield was obtained from the application of one-fourth at planting time and three-fourths at chopping."

Results from the Tifton Station in Georgia point out that it seems better to apply most of the nitrogen to cotton as a side-dressing about squaring time.

It is highly important in cotton production to follow such practices as will give large yields—a bale per acre if possible. It is essential that a large number of squares be set early. To this end and to beat the boll weevil, cotton must be spaced thicker than formerly. Good stands of thickly spaced cotton stalks require a liberal application of quickly available nitrogen.

Experiments to study fertilizer for corn in the lower South show that where corn follows cotton or other well fertilized crops it is not economical to use much, if any, fertilizer before planting. Under such conditions it is recommended that corn be side-dressed with 36 pounds of nitrogen, the amount contained in 225 pounds nitrate of soda. The application should be made about 40 to 50 days after planting. Applying quick acting nitrogen earlier or later than this produces less corn.

Isolation — Insulation

Condensed from Hog Breeder

P. V. Ewing

CAN you produce 100 pounds of gain on 275 or 300 pounds of feed? Here's a man who is doing it.

Can you absolutely prevent influenza and the allied diseases that cause us millions of dollars in loss each year? Here is a man who is doing it.

Can you farrow several hundred sows and never stay up at night with them? This man never stays up at night, because it's not necessary.

We have been taught to clip off the wolf teeth in new born pigs, but he says it isn't necessary.

Can you farrow several thousand pigs and cut your losses to 2 per cent of the pigs farrowed, or even less? This man does it.

Do you believe insulation pays for hogs? This man knows it pays in feed saved and gains made.

Do you keep your hog house temperature between 65 and 85 degrees winter and summer, and use no artificial heat? This man does, and says it pays.

Can you wean your pigs at eight weeks of age at an average weight of 42 pounds per pig? This man does.

Can you average raising nine pigs per litter? This man does.

Do you weigh your pigs every two weeks? This man does.

Can you eliminate losses or fear of losses of hog cholera? This man never gives it a thought.

What would you think of a man with several thousand pigs, who had a crew working from morning till night giving every pig daily its dose of iron sulphate to prevent anemia? Well, he makes money out of his hogs and checks every operation and says it pays.

What would you think of feeding thousands of hogs on very expensive halibut liver oil to supply vitamins, and figuring the units of vitamins A and D to insure that each pig received its proper amount. He does all this —and I think maybe he's right about vitamins.

You and I always thought gains made on forage crops were cheapest, but he says they are most expensive. He raises thousands of market hogs annually that never set a foot on the earth and that never get so much as a spear of green grass.

Do you think a man is crazy who has a chemist watching his hogs constantly and who changes the protein content every thirty

Reprinted by permission from the Hog Breeder, Chicago, Ill., Jan., 1939

days as fattening progresses, so as to make the most economical use of feed? I don't think so.

I always thought a brood sow needed to be encouraged to take exercise, but he says she will take all she needs of her own accord to keep her healthy.

He emphasizes the importance of salt in the ration, not too much but just enough, and if the amount falls too low gains are slowed down.

Could you ever believe hogs could be raised from farrowing to slaughter on concrete? Well, he's doing it.

This is not a dream, but it gives us some things to think about. It tells us why Europe is not buying so much of our pork and lard as they once did. When a man will take fifty acres of land and keep 2,000 brood sows on it and sell literally thousands of market hogs annually, it means the production of several of our average farms and equals the production of our largest establishments. When I found this man, or rather these two men, I wanted to get their story. These two men are the Wilson brothers, R. Clement Wilson, of Belfast, North Ireland, and Mr. A. C. Wilson, of Manchester, England, who have farms and factories located throughout Ireland, Scotland and England.

They were in Chicago recently in the interest of their far flung industries and in their call at our office their story was so interesting that I asked Mr. R. Clement Wilson if he would not dictate a brief message to the hog raisers of the United States, especially describing their success in preventing pig flu. Here is his message:

Reduction of Mortality in Young Pigs by the Control or Prevention of Piglet Influenza
By R. Clement Wilson,
Managing Director,
Newforge, Ltd., Belfast,
North Ireland

This piglet influenza affects young pigs two to three weeks old and is transmitted from one pig to another by a droplet infection which, under normal conditions, will not carry more than six feet, but is usually coughed or sneezed from one pig to another. The presence of piglet influenza is evidenced by sneezing and coughing of pigs whenever they are distributed and is sometimes erroneously believed to be due to worms in the throat. Death from pigs suffering from influenza takes place at any time from two right up to eighteen weeks of age. Pigs that have survived this trouble, however, never thrive as well as pigs that have never suffered from influenza. The length of time taken to finish a pig which has suffered from this trouble may be increased by two months, with the re-

sult that the feeding operation is definitely uneconomic.

In order to rear a herd immune from this disease, it is necessary to breed from sows at least fourteen months old, since up until that age there is no guarantee that the sow herself is not suffering from the trouble, which she may transmit to her young, but after fourteen months of age it is rare that any disease is present in the sow. This sow should be placed in an outside insulated hut placed in a penned, paved yard. The insulation in the hut should be sufficiently efficient to insure a maximum temperature in the summer of 75 degrees and a minimum temperature in the winter of 60 degrees, although the ideal temperature should be 65-70 degrees. In our own farm during this summer the average temperature in our breeding huts has remained stationary at 75 degrees without any ill effects. Our breeding huts are triangular in shape and are not more than six feet square floor area, with a six foot height to the apex of the triangular cover. The room, sides and floor of these breeding huts must be insulated with sawdust, peet moss or other material and the limited space permitted insures that the heat radiated from the sow and her young pigs is sufficient to maintain a reasonably high temperature without the necessity of artificial heat. The sow is fed from her own trough situated at the far end of the cement paved yard, the whole of which is sixteen feet square. A covered-in space to which the sow cannot get access is provided the young pigs. Water may be supplied by pipe system or from barrels equipped with automatic drinking bowls. Each unit consisting of hut and enclosed yard must be at least six feet apart so as to prevent a spread of influenza, should it accidently be present in any particular litter of young pigs. Any sign of sneezing or coughing by any pig in the herd should immediately arouse suspicion that influenza is present and this pig together with the litter in which it has come in contact, should be immediately isolated.

By rearing litters in outside huts, not too close together, and from sows at least fourteen months old, it should be possible to rear a herd of pigs completely immune from piglet influenza. However, on occasions it may be necessary to purchase young pigs from markets or farms where no guarantee of immunity from this disease can be given. While it is desirable to purchase pigs free from coughing if the necessary precautions are taken with coughing pigs the mortality need not be very great. The most important factor in controlling this trouble is the temperature and it will be

found that if pigs suffering from influenza or coughing are kept in a uniform temperature of not less than 60 degrees, while they may suffer for a time from influenza, they will rarely succumb. It is seldom that the influenza in itself kills any pigs, but it reduces the vitality and whenever the pigs are then subjected to a drop in temperature they contract pneumonia and other fatal diseases. It is a good plan to isolate all coughing pigs from the main herd and keep them together, if convenient, in a house where the temperature can be carefully controlled and where drafts are completely eliminated.

The capital expenditure necessary to convert existing pig farms to the new methods would be prohibitive and some breeders and feeders have achieved a very high standard of efficiency by converting existing communal breeding and feeding houses as follows:

On top of the ordinary concrete partitions they have built a superstructure, consisting of any cheap material such as three-ply wood or composite sheeting. This has the effect of inclosing all the pens into separate compartments, but from each of these inside pens there must be access through a draft-proof passage into an outside run. The temperature of these inside cubicles should not be less than 60 degrees, but it is advisable to place a large crate or box inside this cubicle in which the pigs can nest and, as the result of the heat from their own bodies, they maintain a temperature as high as 75 to 80 degrees. The entrance to these inner nests should be closed in by hanging across them heavy sackings and quite frequently pigs will be found lying inside with just the tip of their snouts protruding out from the box. All pens, particularly where breeding is taking place, should be equipped with a thermometer which gives the maximum and minimum temperatures reached in the twenty-four hours, and a careful record should be kept of the readings throughout the twenty-four hours. It will be found that if ever the air in the pen in which pigs suffering from influenza are kept is allowed to drop below 56 degrees, in two or three days some of the pigs will be found to be suffering from pneumonia and probably a number will die.

If young pigs are reared from an immune herd under proper conditions and are free from all evidences of sneezing and coughing, they may be safely put into the large communal feeding houses without much risk of their suffering from any trouble, provided the temperature is carefully controlled. If, however, one pig is purchased from outside suffering from influenza, it will

quickly spread the disease through the communal feeding house and maybe throughout the whole herd.

The reason why this trouble is more prevalent on big farms than on small farms is due to the fact that only in the largest pig breeding stations are there sufficient number of pigs at a critical state to perpetuate the disease. On small farms, where only one or two sows are kept, and very frequently in separate small huts, the herd may suffer from influenza only occasionally, and whenever he sells the affected litter he may be clear before the next litter is put onto the premises, while all huts should be carefully washed out and disinfected regularly, it has been found that this disease is seldom retained in an empty building for more than twenty-four hours. The whole success of pig breeding and feeding may be summed up in two words—isolation and insulation.

The information contained in these notes has been proved to be correct on three or four of the largest hog farms in Ireland and on our own experimental farms, where this summer we were able to wean pigs at eight weeks old with an average weight of 42 pounds each, or an increase of an average of 12 pounds per young pig heavier at the same age than we had done previously. Our losses from birth to weaning on a test lot of thirty-two sows and their litters was 2 per cent, and 1 per cent of this was due to the pigs having accidently swallowed a quantity of sand, causing digestive trouble. The information on which our methods are now based was procured from a large German research station by a veterinary research chemist and large farmers from Ireland who visited Germany last year on the instructions of the North of Ireland government; the North of Ireland government, having over the last two or three years done a tremendous amount of work unsuccessfully to combat high mortality on our pig farms, are now satisfied that in this new method of control they have achieved complete success.

To say the least, these men and others have developed an intensive hog raising program that may have a far reaching effect. It is the result of a new European economy and the secret of the plan originated with German scientific workers. We ordinarily think of Germany as a second-rate hog country, but when they have over 25 million head in Germany proper and over 30 million head in the greater Reich and make it suffice for less than 90 million people, it is possible they know some things about hog raising we might well ponder.

Plant to Prosper

Condensed from Nation's Business

Robert Talley

"IT surely feels great," said H. L. Majure, a 49-year old Arkansan, the other day when he paid off the $400 mortgage on his 40-acre farm.

Mr. Majure is something of a symbol of a new era that is arising in the Cotton South.

Three years ago he was a tenant farmer, living in a ramshackle cabin and worried about his uncertain future. Today he owns his farm, has on it new barns, outhouses and a modern six-room house, raises livestock and diversified crops. Last year, his first on his own farm, he netted a profit of more than $1,000.

That may sound like a dream or a Horatio Alger story, but it really happened. Moreover, Mr. Majure isn't alone. In the South's Cotton Belt today there are thousands like him. Some of them are share croppers, some renters, some farm owners—but all of them are determined to break away from the Cotton Belt's traditional one-crop system and grow their own food and feed on their own farms.

This new movement is the Mid-South Plant to Prosper Competition, conducted annually by the Memphis *Commercial Appeal* and the Memphis Chamber of Commerce. It is a plan that has brought about a practical and productive relationship between business men and the farmers in their trade territory.

The *Commercial Appeal* and the Memphis Chamber of Commerce launched the competition in 1934. At that time the farmers were taking 40 per cent of their cotton acreage out of production in accordance with the Government's cotton reduction program and the Government was suggesting that this idle land be developed for a live-at-home plan. The *Commercial Appeal,* which had preached diversified farming for 20 years, saw an opportunity for a large scale demonstration of its principles. The business men of the Chamber of Commerce saw the necessity for a contiguous farming area that would be economically self-sustaining, no matter what happened to cotton.

They co-operated to encourage the live-at-home plan, announced cash prizes and trophies to be awarded to farmers making the best use of their former cotton land.

The plan's aim was simple but

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powerful. It introduced a new economic system that would enable a poverty-ridden share cropper to earn a farm of his own if he was willing to work; moreover, the plan emphasized to all cotton farmers the necessity of making their farms self-sustaining units by producing more food and feed.

The first year only 1,800 families participated. Last year 27,000 farm families took part through the *Commercial Appeal* alone, and 15,000 more through newspapers in three southern cities to which the campaign had spread.

Frank R. Ahlgren, executive editor of the *Commercial Appeal*, and R. B. Snowden, Jr., chairman of the Memphis Chamber of Commerce Agriculture Committee—pioneers in the movement—are confident that the number of participants in 1939 will be even greater.

The scope of the Plant to Prosper movement was pretty well outlined by Chester C. Davis, member of the board of governors of the Federal Reserve system, in addressing the winning contestants at Memphis last December. He said:

"In 1938 the Plant to Prosper competition covered an area of 392,000 square miles. It is estimated that the families engaged in it increased their production of feed crops, other cereals and hay, to the value of $3,000,000 this year. The increase in the value of the food they produced for their use—canned, preserved or consumed—is estimated at more than $5,000,000. Six hundred thousand acres, or more, the acreage removed from the production of cotton on these farms, were planted to cover crops to protect and enrich the soil."

The mechanics of competition are simple. Competing farm families keep careful accounts on Plant to Prosper record books which the *Commercial Appeal* distributes free. The county farm agents check these records. At the close of the annual competition each December, a committee of judges selects the winners on the following basis:

1. Living at home, 40 per cent. This includes the raising of the family's vegetables, meats and feed for livestock.

2. Diversification, 20 per cent. This means the raising of more than one money crop, the more the better.

3. Soil conservation, 20 per cent. This includes crop rotation, cover crops, terracing and similar approved farming methods.

4. Home improvement, 20 per cent. This means improvement of the farm home as far as the farm income will justify.

Nearly $5,000 in cash prizes, donated by the *Commercial Appeal*, the Memphis Chamber of Commerce and various local organizations in 250 Mid-South

counties are awarded the various winners in Arkansas, Mississippi, Tennessee and certain sections of Missouri, Kentucky and Louisiana which the plan covers.

The *Commercial Appeal* awards silver trophies to the champions in the tenant, farm owner and plantation operation classifications. From among the various winners is chosen the Mid-South sweepstakes champion who receives a cash award of $500 and the Mid-South Plant to Prosper Trophy in addition to the $100 he collects as champion of his state.

The Mid-South champion the first year was J. H. (Bud) Sanders, a tenant farmer of Decatur County, Tenn.

Mr. Sanders had been farming for years but before 1934 had never tried to raise anything but cotton. When the Government cut his cotton allotment to less than 20 acres, he turned to other crops to supply his family needs.

He planted a garden, raised chickens and hogs, kept a cow and, that year for the first time, was able to keep his children in school the entire term.

The Mid-South Champion in 1935 was George P. Harris, a land owner of Winona, Miss., who taught his seven Negro tenant families how to "live at home." Mr. Harris, who had won the Mississippi championship in the 1934 contest, had continued to practice diversification as well as spread its gospel.

Encouraged Tenants

He encouraged his colored tenants to grow their own food and feed crops, something they had never done before. He terraced his land to stop erosion, planted cover crops to conserve fertility, added beef cattle and hogs to his farm output and grew so much feed that he made an extra profit on it. On land that yielded 55 bushels an acre he produced more than 150 tons of corn.

Even more remarkable than Mr. Harris' victory was his record as a former share cropper who had worked himself up to become a farm owner. At 21 he had started share cropping. Four years later he stretched his credit to buy a 730-acre farm. There he and his young wife started their honeymoon in a one-room cabin. He reduced the number of tenants from 14 to 6, and in six years he had the land improved and paid for.

When his two boys who were born in the ramshackle cabin grew up to school age, Mr. Harris sold this farm and bought one nearer the school and the church. He paid part cash and assumed a $10,000 Federal Land Bank mortgage. The farm lay in a creek bottom and the first year he caught big catfish on land that he later drained and put into cultivation. The farm continued to

make good crops and in four years the land bank was paid in full.

Before the cotton slump the Harris farm grew little food or feed. Now his tenants have their own gardens, chickens, milch cows, free pasture and plenty of fat hogs at killing time. Most of these tenants have dug cellars under their houses for potatoes and canned fruits, and all of them have their own corn fields and corn cribs.

In 1935 the Mid-South winners were Denton Fly, a 32-year-old church elder and land owner of Milan, Tenn., and John E. Shannon, a 49-year-old tenant farmer, of Jonesboro, Ark., and father of nine children. The former received the $500 sweepstakes award and the $100 Tennessee state award, plus the *Commercial Appeal's* Trophy; the latter received a $250 award as the Mid-South's champion tenant farmer, plus the $100 Arkansas state prize.

What Plant to Prosper means to the Mid-South's traditional Cotton Belt is told by Mr. Snowden, speaking for the Memphis Chamber of Commerce's agricultural committee:

The one-crop farm must go if there is to be economic freedom for our southern farmers. In its place must be planned farms that grow diversified crops so that, first, the family is well fed, and, second, so that there is a surplus to insure immediate cash income.

We have come far in the five years that Plant to Prosper has flourished, but it is only the beginning. There is work—and more work—to be done. It is not enough that 42,000 farm families in the South are acquiring better homes, bigger incomes, finer health. The number must be doubled and then tripled and then quadrupled. It can be done. There is hardly a farm in the South that is not potentially a self-sustaining unit.

Feeding Calves for Baby Beef

Condensed from The Shorthorn World

David I. Day

ANY live stock market bears out the statement that very few animals arrive too fat. A large number arrive regularly which are too thin. Peak prices are paid for prime stuff, the lowest prices of the year for common. If a feeder must market common calves, he should aim at the scales along in April or May when the demand is keenest for that kind of beef and correspondingly lowest on the calendar for fine animals.

Visits to good feeding farms reveal anew that it takes skill to feed and care for calves so they will be in prime shape and ready for market at 700 to 1000 lbs. A first lesson is to get the calves eating grain or a grain mixture before they are weaned. As a southern Illinois farmer expressed it: "It's the only way to keep from losing a lot of that fine milk fat. Our Shorthorn cows are good mothers. They give the milk. We furnish the grain mixture at the right time. The result? No shrinkage at weaning."

Some practical feeders start the three-months old calves on grain in a creep. Others separate calves from mothers except for nursing periods, three times daily for a month, twice daily thereafter. They get grain, hay, and sometimes a bit of silage between nursing periods and it is true that there is no appreciable weaning shrinkage manifested on those profit-making farms.

A good simple grain mixture for feeding calves still getting milk was in use on an Illinois hill farm, where 1140 lbs. of ground corn, 600 lbs. ground oats, 200 lbs. linseed meal, 20 lbs. steamed bone meal, and 20 lbs. salt thoroughly mixed constituted a full ton.

"There is a trick to managing beef calves after they are weaned, too," commented a good Illinois feeder one afternoon. "Most folks figure a beef calf as a stolid, phlegmatic creature, whereas the opposite is true. A shorthorn calf at weaning time is a nervous, temperamental animal, feeling that his whole life is being strangely shaken up. We get by this condition by providing comfortable box stalls. We see that the calf is not too lonely, for if one gets fidgety we put another calf in with it for company. After weaning, the first few months is

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the critical period in feeding out baby beef. It is not a matter of book learning. It is a matter of sound feeding judgment. For about eight weeks, the amount of grain and protein concentrate must be gradually increased but not fast enough to throw the animal off feed. Feeders really contravene nature at every turn. The calf naturally tends to growth instead of fattening. The farmer's job is to fatten it anyway so he strives to get the animal to consume proportionately much more grain and much less hay and silage than would be eaten by older cattle.

Variations in feeding systems are found on various farms. However, all are based upon the principle of a gradual approach to full feeding. About the best idea is used on a good Missouri stock farm, home of grade and purebred Shorthorns for a generation. The first day away from the mother the calf gets approximately a pound of grain mixture and one-eighth pound of high-protein concentrate. For ten days the calf gets an increase of one-fourth pound of grain and a corresponding increase in linseed meal, cottonseed meal, soybean oil or any other concentrate in use. When the calf at the end of ten days is cleaning up with a relish about three and one-fourth pounds of grain up to three and one-half pounds with a little less or more than one-half pound of concentrate, there comes what they call on that farm a "four-day halt."

No further feed increase is made during that four-day period and the calf is closely observed. Is the animal eating its grain allowance readily? Does it relish the grain feed? If so, the one-fourth pound of ground grain increase daily starts up again, with protein concentrate increase about one-eighth as much. This increase continues so long as the calf eats up its grain and protein concentrate allowance in a reasonable time, usually fixed at two hours.

Once in a long while a calf under this sort of feeding will go slightly off-feed but the appetite can usually be restored by letting it miss one or two feedings. No ironclad rule prevails because the individuality of feeding calves and that vague thing—feeding judgment—play too prominent a part. Where ground grain mixture and protein supplement are fed to calves separately under the full-feeding point, the farmer naturally has a little more direct control. Even then, however, if linseed meal is not in regular use, many feeders keep it as a conditioner if calves manifest a bit of roughness. However, mixing ground grain and protein supplements together is a custom on the increase, and one splendid beef feeder in particular keeps direct

feeding control with a separate bag of barley mixed with ground corn to stimulate fat and another bag handy containing prime quality old-process linseed meal if something additional with a tonic effect seems desirable.

When the calves reach the full-feed point, consuming one and one-half to two and one-half pounds of grain daily per each 100 lbs. of live weight and a proportional amount of protein supplement, the worst is over. Just sufficient feeding skill is required afterward to increase grain and supplement allowance to keep step with the growth and development of the animal.

Different rations are popular, too, after the full-feed point has been reached. Some farmers engaged on a long feed like a good Missouri mixture made of 600 lbs. ground corn, 560 lbs. ground barley, 400 lbs. ground heavy oats, 200 lbs. wheat bran, 200 lbs. cottonseed meal or linseed meal, 20 lbs. salt, and 20 lbs. steamed bone meal. This is fed with clover or alfalfa hay and corn silage if available.

A mixture for a medium-long feed was explained to us by a good Missouri feeder. He likes to use well-mixed 1000 lbs. ground corn, 500 lbs. ground barley, 300 lbs. wheat bran, 180 lbs. of cottonseed meal, and 20 lbs. salt. A fast-fattening feed is in use in Iowa, simply 1700 lbs. ground corn, 180 lbs. cottonseed meal, 100 lbs. linseed meal, and 20 lbs. salt. Both of these mixtures are for use with plenty of legume hay for the purpose and silage occasionally if available.

For our friends, west and southwest, who may be interested in these baby beef mixed feeds, let us say that ground kafir, ground milo, or other ground sorghum grains, or ground barley can be substituted, we feel certain, for any part or all of the corn mentioned without making a material difference in the results. On some Shorthorn farms, ground wheat has been substituted, pound for pound, for the ground corn. In case of necessity, less oats can be used and more wheat bran. While on the subject of substitutions, we can say that farmers on the trip showed the possibility of using sudan, cane, or prairie hay instead of legume hay. In each case, more cottonseed meal or linseed meal was used and up to 60 lbs. of ground limestone per ton was added to the feed mixture.

The difficulty with all emergency rations seemed to be the retention of palatability. Palatability is much more important in feeds for baby beef cattle than in most feeds. Of course, good calves will take almost any well-balanced ration and make fair gains. However, in long feeding periods, calves may refuse at

times to eat, and that is true especially in spells of hot weather. We have heard of fewer cases of this sort with Shorthorns than with any other breed but it happens at times with any calves. Here is where molasses is worth much more than it costs. Take any good feeding molasses, dilute with warm water, and pour over the grain ration just before feeding. Some farmers have had success stimulating the appetite of baby beef calves by slightly cooking such grains as whole corn and whole barley but this is usually considered too much trouble.

It is commonly believed that with the popularity of molasses as an appetizer we catch a glimpse of a future when molasses will be included in more baby beef grain-and-supplement mixtures. Molasses mixing equipment seems destined to take a corner in every little cornbelt feed mill so inclusion of the sweet product will be easily arranged for by the beef feeder with the result that less corn will be needed, palatability will be increased, and baby beef animals may be carried to market time with finish and with a minimum of trouble to the farmer.

Some Like It Hot — Some Like It Cold

Condensed from The Ayrshire Digest

Professors W. M. Regan and G. A. Richardson

University of California

THAT heavy milking dairy cows can withstand long periods of as low as zero weather with little change in production, but react unfavorably when exposed to higher than 85° temperature, are the conclusions reached by Professors W. M. Regan and G. A. Richardson, who have conducted extensive studies in their laboratories at the University of California at Davis.

The findings of these scientists were made possible by the construction at the California Experiment Station of an air conditioned room, large enough to house two mature cows and to permit the control of temperature, humidity and air movement. In these rooms were stabled at different times six pairs of cows. Temperatures varied from 40° to 100° F. during the five month period in which these trials were under way. With the exception of temperature, conditions were kept just as nearly normal as possible. An air velocity of fifty feet per minute, and a relative humidity of 60% were maintained.

All cows were given a standard diet, fed in accordance with their individual needs, and had free access to drinking water at all times. Their rectal temperature, pulse and respiration rate, together with the amount of feed and water con-

Effect on Respiration Rate, Body Temperature and Pulse Rate of Varying Environmental Temperatures

Room Temp.* °F.	Respirations Per Min.	Rectal Temp. °F.	Pulse Rate Beats Per Min.
40	12	101.0	—†
50	17	101.0	72
60	28	101.0	68
70	42	101.3	63
80	56	101.8	61
85	70	102.2	59
90	88	102.7	60
95	106	103.7	57
100	124	105.1	—†

*Air velocity at 50 feet per minute. Relative humidity constant at 60%.
†Not recorded.

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sumed, were recorded twice daily for each animal. The cows were held for periods of from five to ten days at temperatures ranging at 10 degree intervals from 40 to 100 degrees. The data for the first days of each period were not included in the averages.

Much was learned by Messrs. Regan and Richardson as they watched how their charges performed when they "turned on the heat." The data show (see table) that as temperatures increased, production declined. Cows that had been producing an average of 27 to 29 pounds— per day while temperatures ranged from 40° to 70° declined to 17 to 20 pounds when temperatures were raised to 90° to 95°.

Contrary to the opinion of many practical cattlemen, butterfat tests did not decline as (artificial) weather conditions became hotter. On the other hand, "solids-not-fat" and particularly the casein content, declined with an increase in temperature. The physical and chemical characteristics of butterfat also changed under these conditions.

These investigators report that the average dairy cow does not perform well under warm conditions because she is not fitted to withstand hot climates. They also state that they have found a distinct breed difference.

As every cattleman knows, the normal body temperature of the cow is between 101° and 102°. In order to maintain it within these limits, the heat produced by the animal must equal that lost from the body. These studies indicated that when the cows in this experiment were held at a temperature ranging from 80° to 85° for more than twenty-four hours, they had difficulty in regulating their temperature, with the result that heat production over-balanced heat loss, the body temperature rose, and changes occured in the milk characteristics.

It was found that as the room temperature was raised, there was a uniform increase in the rate of breathing. At 40° and 50° the rate of respiration was 12 and 17 a minute, respectively. There was an increase as temperature rose, until at 95° cows were panting at

The Influence of Temperature of the Environment on Milk and Fat

Temp. °F.	Milk Production Lbs. Per Cow Per Day	Fat %	Solids— Not Fat %	Casein %
40	29	4.2	8.26	2.26
50	28	4.2	8.26	2.28
60	27	4.2	8.06	2.08
70	27	4.1	8.12	2.05
80	25	4.0	7.88	2.07
85	23	3.9	7.68	1.93
90	20	4.0	7.64	1.91
95	17	4.3	7.58	1.81

the rate of 106 per minute, and at 100° at 124 per minute.

The effect of heat on the pulse rate of a cow is quite different from man. While the pulse beat of the latter speeds up as the "effective temperature" rises above 95°, that of the former tends to slow down. At 50° the cows in this experiment had a pulse rate of 72 and at 95° they were down to 57. As stated above, man's first line of defense against extreme heat is to increase the flow of blood through the capillaries of the skin, which facilitates the elimination of heat from the body. This is accompanied by a speeding up of the heart action. A cow's dry skin in a hot environment may actually acquire a temperature above that of the body, in which case increasing the rate of circulation would tend to place an added burden upon the heat-dissipative mechanism. Thus, a slowing of the heart rate is actually beneficial.

In an effort to determine the amount that a dairy cow perspires, an experiment was conducted by taping inverted dishes on the rump and loin of two Jersey cows. Filter papers, impregnated with calcium chloride were fastened in the bottoms of the dishes and the moisture emitted during an hour was determined. It was found that at 84°, each cow transpired from her entire body surface about 1 pound of water. To determine whether or not this moisture resulted from sweat gland activity, the cows were washed with distilled water, after which the temperature was raised to 100° for one hour. The cows were again washed, and since the wash water gave a negative test for chloride it was concluded that no sweating had taken place.

Therefore, since unlike man, the cow's skin does not perspire, except in very limited areas and is capable of holding heat, it is possible for her to adapt herself to conditions of extreme cold without discomfort. This helps to explain why exposure to zero weather may bring about neither lowered production nor increased maintenance requirements.

According to Messrs. Regan and Richardson, because the cow's heat regulating mechanism functions in such a radically different manner for that of man, one is not justified in applying the comfort standards worked out for man to the management of cattle. The changes in composition and physico-chemical characteristics of milk when a state of positive heat balance is reached, probably result from blood changes instituted to facilitate heat disposal.

Electrocution for Dairy Farm Flies

Condensed from Electricity on the Farm

G. H. Dacy

DOWN in southern Florida where the tropics begin, flytime is not seasonal but a year-around source of annoyance, particularly on dairy farms. Sanitation, sprays, and fly swatters fail to control the winged pests; electric fly traps, however, have proved remarkably successful in the abatement of the fly evil. Thomas and Reasoner, successful Dade County dairymen, who milk as many as 300 grade Guernseys and Jerseys, report that the latest fly-electrocution devices are highly efficient, much superior to the pioneer types of fly catchers which were objectionable because they shorted out too easily. This is the eighth year that these milk producers have yoked electricity for fly-killing. Despite the fact that molasses is a constitutent both of the dairy feed and beet pulp which they use—molasses is a favorite delicacy among the fly species—their milking stables and pastures are outstandingly free of horn flies and similar pests.

One of the fly traps is located in the spacious feed room which accommodates several carloads of dairy feed. The flies which penetrate to that storehouse are attracted to the insect-killer by an electric bulb which is illuminated during the feeding and milking periods. The pesky flies settle on the wires of the trap, lured there by the light or are electrocuted by venturing too close. The odor of frying flies attracts more of the trespassers which meet similar fate. Dead flies on occasion have been removed by the quart from the vicinity of this efficient and economical fly trap.

Outside the milking stable two other electric fly traps are mounted at strategic points where flies tend to congregate. Each cow in entering and leaving the stable passes through separate closed chutes which are rigged up as fly destroyers. Passage through either of these chutes is blocked by a barrier composed of two rubberized curtains; strands of heavy rope are attached to the curtains. Each set of curtains has a central head hole something like the opening in a steel stanchion; this opening is the same distance above the floor of the chute as the normal position of the cow's head. She sees daylight through the hole, pokes her head into it and thus forces the cur-

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tain apart; the rubber and rope brush the flies from her head, body and legs as she passes through the entrance or exit to the stable. An electric lamp at the top of the chute lures the insects brushed from the cow to the electrified grid whose surface is about the same size as your daily newspaper. Flies that venture too close to the electric trap or which even settle on the grid are killed immediately; the active irritators of dairy cows, especially the objectionable horn flies, are disposed of readily in this effective manner.

These Florida dairymen also have installed runways and similar chutes at key points throughout their pastures which aggregate 700 acres. You would be surprised to see the wholesale execution of flies which is effectuated by this practical plan of fly control. The dairymen also carry the campaign back to the source of origin of many of the flies such as manure accumulations and other refuse. This debris and fertilizer are cleaned up regularly and thoroughly in order to reduce and control the breeding grounds of the flies.

Soil Acidity

The relative acidity or alkalinity of the soil is commonly expressed in terms of the symbol pH. The neutral point in the scale is 7. Soil testing below a pH 7 is acid; soil testing above a pH 7 is alkaline. The pH values are based on logarithms, 10 being the base. Therefore a soil testing pH 5 is 10 times as acid as a soil testing pH 6; while a soil testing pH 4 is 100 times as acid as a soil testing pH 6. In going either up or down the pH scale from the neutral point of 7, the value of the unit is 10 times greater than the next one approaching 7.

The Influence of Sanitation in Farm Feeding

Condensed from The Rural New-Yorker

Howard J. Eshelman

TO the feeder, cleanliness is decidedly of first and not secondary importance. If I were asked to name the one factor which, in my opinion, influences the success or failure of the feeder more than any other, my unhesitating answer would be sanitation.

The reputable manufacture of commercial mixed feeds extends every effort possible to bring to the feeder a clean, sanitary, healthful, palatable product, accurately formulated, in order to produce the greatest possible profit for the feeder. The manufacturer is just as desirous as the feeder that his products should prove resultful, because he realizes that upon the feeder's success depends his own. In a modern feed manufacturing plant, cleanliness and sanitation is a first essential. In maintaining this high ideal—from the selection of raw materials to the packing of the finished product and the loading of cars, vast sums of money are saved for the feeder every year. Every shipment of the raw materials and of the finished product, both inbound and outbound, is cleaned and recleaned to prevent foreign matter from finding its way to the feeder. Milling and manufacturing equipment is kept just as scrupulously clean as it would be if used for processing human foods. Even freight cars, in which commercial mixed feeds are loaded for shipment, are first cleaned and then lined with heavy paper as a final means of protection against contamination of the feed. Science has made contributions of inestimable value to the feeder, but unless he keeps his animals and equipment clean and sanitary, the efforts of the scientist, and the manufacturer, are to no avail.

Frequently when feeders do not secure profitable results from well-known brands of commercially mixed feed, the trouble is found to be lack of hygiene and sanitation. Only one sample, for instance, out of more than a thousand samples of feeds of various manufacturers, submitted by feeders to an Ohio Station for

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examination, was found to be in any way detrimental. In many cases the animals which consumed the feeds in question and died, were autopsied. In practically every case disease was found to be present, and the feed in no way responsible. This speaks remarkably well for commercially manufactured feeds.

Poultry in the United States represents a billion-dollar industry and has attained second place in agricultural importance. Proportionately, the amount of money wasted because of mortality in chicks and in the laying flock, because of disease, retarded production, and many other reasons, is appalling. Many of these losses are directly due to lack of sanitation, which could be controlled. While perfect sanitation is hardly possible, the more sanitary methods that are adopted, the less chance there is for disease to become established.

As a case in point let us take the poultry disease coccidiosis. It has been proven time and time again that 100 percent of a flock can be raised completely free of coccidiosis, without the use of medical treatment, or any preventive other than rigid sanitation. Once the flock has been infested serious damage has occurred and treatment is then useless. Just one little mud puddle in the poultry yard, one spot of dampness in the house, will provide the opportunity for infestation.

A parallel condition exists on the dairy farm. The dairyman has a good-sized cash investment in cattle, barns, pasture lots, equipment and feed. The laws which in many States control the production and sale of dairy products, have been born of necessity. Cow testing and dairy associations, and county agents, are the dairyman's best friends. Their aim is to protect, and not penalize the dairyman. They, as well as the manufacturer of commercial feeds, aim only to help him raise the quality of his product. Through their labor and influence many of the troubles which were a constant source of dread to the dairyman (tuberculosis and Bang's disease, for example) have been eliminated entirely in some communities, and are under complete control in others. The public has always been, and is today, willing to pay a fair price for a quality dairy product. But the dairyman himself is the most important link in the chain, and unless he willingly co-operates by keeping his cattle, milk and equipment thoroughly clean and sanitary, the efforts of those who aim to help him, are wasted. The bacteria count of milk is a factor in determining the price at which milk is bought and sold. The dairyman alone stands to lose if he is not

in sympathy with modern standards of hygienic methods of production.

A dangerous source of infectious diseases, in both the poultry and dairy fields, lies in the use of second-hand bags, even though the manufacturer takes every precaution to prevent contamination by fumigation and thorough cleaning. Reputable manufacturers discourage the use of second-hand bags because they believe that the few pennies that can be saved are not sufficient compensation for the dangers involved in this practice.

Sanitation need not be costly but it pays big dividends. The labor and equipment invested in a worthy system of hygiene, no matter how elaborate, is far less costly than the loss of a flock, stunted growth, or retarded production. Compare the average egg production per hen per year in most States with the average production per hen of a high-producing flock; then note how closely sanitation parallels production in these cases. The need for greater cleanliness and sanitation immediately becomes apparent.

Modern breeding and modern feeding methods have put the poultry and dairy industries on a far more profitable basis than ever before. The standard of production has been raised to a point that was undreamed of by our forefathers. Educational methods have increased the use of, and demand for, these products accordingly. The feeder's opportunity today is unlimited. Chickens mature more rapidly, put on more meat, lay more eggs; dairy cows produce stronger, huskier calves, and more and richer milk for a longer period of time. On the other hand, many of these animals are more sensitive and temperamental than were their ancestors. Generations ago, when they were in a more primitive state, they possessed great ruggedness and resistance. It is perhaps true that while modern methods have produced a higher type of animal, they have also produced one which has lost some of his natural ruggedness, and is more sensitive to infection. And although warm, dry quarters and similar conditions (which are necessary today) add greatly to the comfort of modern farm animals, these same conditions are just as favorable to their common enemies such as lice, mites, germs and parasites, unless extraordinary preventive measures are adopted systematically and regularly, and sanitation becomes the rule rather than the exception.

Efficient Farming

Condensed from The Farmer

Andrew Boss

Farm Department Editor of The Farmer

AS farmers study their farm plans for this year, they should keep in mind that the matter of improving net income may be approached from two angles—1, by increasing gross income, and 2, by reducing production costs.

Gross income may be increased by larger production, by an increase in prices, or by a combination of the two. Most farmers can arrange to increase production if it seems desirable, but the individual farmer has little influence on prices for agricultural commodities. Since it does not seem desirable this year to increase production of any of the staple cash crops, dairy products or hogs, attention should turn to reducing cost of production. Economy is the keynote of the 1939 program.

First comes economy in livestock production. Whether beef cattle or dairy cattle are kept, cheap feed and plenty of it is the first requirement. That begins with pastures and forage crops. Since cattle on good pastures can wait on themselves, pasture-made products are produced at low expense. If pasturage is abundant and of good quality, high gains and yields will be made, which result in low cost products. Low costs means larger profits. It is quite possible to provide good pasturage in many sections for a season of 180 to 200 days. The tame grass and legume pastures should be supplemented with short-term pasture crops during midsummer, and in early spring and late fall. The coarse grains such as oats, barley and fall rye, and Sudan grass, serve this purpose nicely.

There is no good reason for being short of pasture feed, except in years of extreme drouth and fortunately they do not come often. The longer cattle can feed themselves on pasture, the lighter will be the cost of labor in caring for them. Pastures of mixed grasses and legumes yield well-balanced rations. But little grain need be fed unless extremely heavy production is desired. Moderate production at low cost often yields more net profit than high yields at high cost.

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Cattle must be carried on cured forages for nearly half of the year. It is important to provide a reasonably well-balanced ration of good quality and palatability. Legume hay should be the foundation on which rations are built. Alfalfa is the favored crop for this purpose. The clovers and soy beans can be used to advantage where alfalfa is not available. Alfalfa hay, combined with a light corn, oats and barley grain ration, will satisfy the requirements of all classes of ruminants. Dry stock or idle stock will need little but roughage if of good quality.

Labor-saving methods of care should be employed, thus making the family labor go as far as possible, and saving the expense of hired help. Self-waterers, self-feeders and well-arranged yards and bunks can be used to advantage for beef cattle and sheep.

Pasture and forage crops should have first consideration in planning the year's program. Corn and other feed grains come next, with cash sale crops taking up the surplus land not needed to supply the needed feed crops.

Hog production costs can be lessened also by providing good pastures for brood sows and litters. Losses of pigs can be avoided by providing sanitary quarters at farrowing time and subsequently. Labor cost can be lessened by letting the pigs make hogs of themselves at self-feeders and waterers, and by hogging down some grain crop or early corn as they approach the fattening stage. It is surprising how much a hog can do for itself if given a chance. If alfalfa pasture is not available, a good substitute can be grown in four or five weeks by sowing a combination of oats, one bushel; barley, one bushel; Dwarf Essex rape, three pounds an acre. Repeat six weeks later for a midsummer pasture.

For sheep and poultry, similar conservative policies should be followed. On many general farms feed costs for these classes of stock are not great, as they live on waste and by-products from the feed yards and grain fields. Where either enterprise is developed as an important part of the farm business, some accessory feeds may be needed. This is especially true for heavy producing poultry flocks. The base should be farm feeds with a minimum of purchased supplies.

The second consideration is economy in crop production. One is not so likely to waste labor on crop production as on livestock. The greatest source of error is perhaps in trying to cover too many acres not especially adapted to the crop grown. The largest return for labor on crops will be obtained when applied to a good quality crop on highly productive land, for instance, hy-

brid corn on well-prepared, well-conditioned corn land. Forty acres of corn on first-class land may yield as much corn as 60 acres on second-class land. The labor of caring for it will be much less. It will be wise to put the poorer crop land into pastures and meadows to insure plenty of forage for livestock, and spend the available labor on the high profit crops grown on good land.

Price relationships continue to favor livestock and livestock products over the grains and feed crops. While numbers of both dairy and beef cows are increasing, and larger farrowings of pigs are predicted, it is believed that price relationships will continue to be favorable to livestock production throughout the year. The 1939 farm program should therefore be built around the livestock enterprises, so far as possible. Improved business and industrial conditions and fuller employment are expected to make it possible to absorb modest increases in animal products without serious disturbances of price levels.

Those not situated fortunately for producing livestock or livestock commodities of one kind or another will have to make a choice from the grain and feed crops.

In accordance with the suggested objective of keeping down the cash expense, the aim in setting up the production program should be to provide in the following order:

(1) Food for the farm family, in abundance and of such variety that little need be purchased.

(2) Feed-grain and forage, in sufficient quantity and variety for the needs of all livestock kept. A little left over is good insurance. Not much money will be lost on livestock production when the feeds are farm grown.

(3) Cash sale crops on land not needed for the first two items.

(4) For maintenance of soil and soil fertility—by use of cover crops, green manure crops and farm manures.

Round Out the Farm Business

Income is made by expending labor on productive farm enterprises, that is, on enterprises that yield usable or salable products. Attention may well be given to the matter of rounding out the farm business by developing production specialties that will more fully employ the available farm labor. Production of hybrid seed corn or other seed crop will fit some farms. Some can take on an acreage of canning crops or sugar beets. Poultry or bees or both may fit in on other farms that have a labor supply not fully employed. The road to profitable farming at any time lies in the direction of high gross income and low operating expense.

Successful Painting

Condensed from Eastern States Cooperator

HOW many users of paint appreciate the fact that quality in this field is the result of the untiring work of the investigator? From the concoctions which are sometimes used, I am at a loss to know just what really does pass through the paint consumer's mind when he considers a purchase of this product. I suspect, however, that in the majority of cases he immediately thinks in terms of white lead (basic lead carbonate) and oil (linseed oil). With this combination, and by means of color and a few other things that are rather vague, almost any type and color of paint can be made.

Without becoming technical at all, suppose we get a "bird's eye view" of just what does go on in the modern paint industry. First, let it be said that there are hundreds and hundreds of pigments used in the formulation of high-grade paints today, and that white lead, to use a military phrase, is simply "one of the privates in the ranks." It is of no more importance than many other pigments, a few of which are: lead sulfate, zinc oxide, the various types of leaded zinc, lithopone, crytone, titanium dioxide, titanox (B or C), magnesium silicate, the various ochres, and many more. These are combined in various proportions, depending upon the surface to be painted and the type of finish desired.

Linseed oil, instead of being the only oil used, has many associates such as tung oil, perilla oil, soybean oil and several others. These are used in the raw form in some paints, while in others they may be cooked together with resinous gums over very hot fires to make varnish. This varnish may not only be used by itself to produce natural wood finishes, but also may be the vehicle which is used to give the gloss in enamel.

Every one of these pigments and vehicles can be obtained in a wide range of quality so that the proper combination which finds its way into the paint can is not a haphazard affair.

We have huge factories, each of which devotes its entire energy to the manufacture and continual improvement of just one pigment, such as the various types of zinc oxide or titanium. There are others that specialize in the manufacture of paint oils, of which linseed oil in its various grades is still "king." We have those which specialize in the

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manufacture of gums and colors, in fact, every ingredient used in paint manufacture has had its share of investigation.

Test Fences: In most cases, the pigment manufacturer maintains what are known to the industry as test fences. These are nothing more than racks on which painted clapboards (weather boards) are laid at a 45-degree angle to weather in the open. Beside these are check fences upon which the same boards are placed in a vertical position as on a building. One year at 45 degrees is equivalent to three years in a vertical position. It is not uncommon to see two miles of these fences being studied by a single manufacurer at an expense of 50 to 100 thousand dollars a year. Research men are in charge of these projects. They continually paint these boards with various combinations of their pigment and those of other types, mixed with various kinds of oils and driers to observe the weathering effect under actual conditions. Examination of the paint is made under the microscope. The paint film is checked for the rate of weathering, type of weathering, elasticity. There are, in fact, many methods of determining results. Definite recordings are taken every few days—more frequently in summer than in winter.

Manufacturers of finished paints are invited to inspect this research work. By inspecting the work done by the various pigment manufacturers, the manufacturer of finished paint is able to get ideas for improvements in the particular type of products required by this group of consumers. Every progressive paint manufacturer, in turn, either maintains a fence on which to check his own formulations or arranges to send painted boards to an outside agency which places them on its fences and makes reports periodically.

Now that we have the formula, how is it put together? For the purpose of illustration, we'll use an exterior paint. The pigments, carefully weighed out in their proper proporations, are put into a mixer with linseed oil and agitated into thick paste. This paste is poured into a grinding mill which reduces it to a very fine texture. The driers, thinners and extra oils are added in specific amounts to bring it to the consistency required for finish-coat work. To this the tinting colors are added as the paint is agitated.

Following all this procedure, a brush-out is made and allowed to dry to make sure that it matches the standard for this mixture. The drying time is checked so that as you use the paint the next sizeable portion of the undecorated surface can be covered without showing the lap.

It must, however, dry soon enough to prevent heavy dirt collection. The mixture is also checked for hiding, covering qualities and finally, for spreadability. If the product meets all of these rigid tests, it is scheduled for the can and for use by the consumer

Farmers know that the best feed in the world will not make a flock of birds profitable; a fertilizer bag that carries a maximum quota of plant food does not guarantee the purchaser a crop; and the best automobile you can buy will not prove satisfactory unless it is properly handled. It has been said that a can of poor paint properly applied will give better results than will a can of the best paint improperly used. In other words, sound management is frequently more important than the commodity; however, a combination of a quality product and sound management will usually give maximum value for each dollar spent.

The careful farmer budgets his paint expenditures in the same manner in which he calculates his expenditures for seed, insurance, or the roof on his home.

Frequently, following a reroofing job, the owner stands back, looks over the result, and remarks with pride: "That's good for 15 years." He will usually reroof at the first sign of failure or will certainly jump into action when the first sign of a leak appears on the inside of the building. On the other hand, the same farmer may look at the exterior of his home and know in his own mind that it needs painting, but because the painted surface is vertical and does not leak, he will say: "Oh, that will go another year." It probably will be allowed to go three before it is finally repainted. This, frequently, will be too long for efficient painting.

Everyone admires a home on which the painted siding presents a smooth surface year after year. But what we too frequently see is a repaint job which has been done over rough, checked surface. This is not attractive when viewed at close range. If the original paint work is done with good materials that have been properly applied and there are no construction defects, the smooth appearance of the surface can be maintained most economically by efficient management.

A carefully-formulated paint, properly applied, will weather by chalking. It will gradually dust away, but will not become hard or brittle, nor will it flake from the surface.

The careful property owner watches for repainting signs. When he notices a board on which the film is so thin that the original surface can be seen or when there are slight signs of cracking or checking, he knows

that it is the most economical time to paint, for it requires less material and the time required for surface preparation will be almost nil. After all, labor is the most expensive part of painting.

A building repainted in this manner will be preserved most economically. The frequency with which repainting is required will depend principally on weather conditions.

If, by chance, water gets behind the siding because of a leaky flashing, a cracked board, or a break in the roof, the careful property owner corrects the trouble immediately. Peeling paint under these conditions is usually confined to a very limited area, small enough so that the old film can be removed economically for the full length of the boards affected and a smooth surface maintained for repainting. When the paint film is allowed to crack, check, or peel over a wide area, the preparation before repainting can be done is very expensive.

Watch your buildings. Paint when the first signs of failure appear.

Since time immemorial, moisture has been the outstanding reason for the paint film loosening from buildings. In years gone by, moisture peeling was usually traceable to:

1. A leaky roof or cornice.
2. A cracked clapboard.
3. New plaster which had not dried.
4. A flashing which was improperly installed over a window, at the junction of the porch and the house, or where an extension had been made to a building. If these were kept tight, a paint film which had been properly applied was seldom loosened by water.

Old houses were open between the studding from the sills to the attic. Here, the rats and mice could run and play and disturb the peace of mind of the occupant. However, the air circulating in these areas prevented moisture from condensing on the backside of the clapboards in winter and thence being drawn through to the outside by the summer sun.

The last decade has witnessed the creating of several new building materials, many of which are designed to make the home both cooler in summer and warmer in winter. These have been accompanied by the advent of humidifying systems.

The majority of these, in themselves, are very satisfactory; but frequently they have been installed in a manner which has been ideal for the condensing of moisture on the back of the outer sidings. Invariably, under such conditions, the summer sun draws this moisture to the outside and takes the paint with it.

Nearly all modern constructions eliminate the rat run and

many eliminate air circulation between the studding. Insulating boards, rock wool, and the like have been installed so that condensed moisture accumulates on the backside of the clapboards. Humidifying systems, in many cases, have been put into houses with the insulating materials mentioned above, and have accentuated the moisture problem. Oftentimes, the paint manufacturer was called in to explain why his product had failed. He recognized the condition as one of moisture, but, in most cases, he marveled at the construction of the building, and was at a loss to trace the source of moisture. It then became a problem for the research worker. He carried on a great many tests to determine the maximum amount of water which could be in a board and still have the paint continue to adhere. It was found that paint would seldom adhere to wood containing over 15 percent moisture, that it would definitely fail to cling to a board containing 20 percent, and that to be within the realm of safety, the lumber should have less than 10 percent for ideal paint adhesion.

To put this information into practical operation, there has been developed a moisture gauge so that the exact amount of moisture in the siding of a wooden building can be definitely measured. This gauge has produced evidence which has saved many paint manufacturers from paying damages on peeling paint films. In most cases on modern homes, it has pinned the cause for unsatisfactory paint jobs down to the failure of those installing new worthwhile building materials to provide a means for moisture to escape. The type of moisture is not caused from the direct entrance of water, but from the condition which is commonly known as sweating.

The length of service given by a metal roof is closely related to the care it is given.

Rust to a metal roof is like cancer to a human. It begins in a rather inconspicuous sort of way, and if not checked, may continue until holes appear here and there. In this stage, a new roof is necessary. Deterioration which takes place from rusting cannot be replaced. A very thin layer of metal has already been destroyed in every rusty spot, but careful attention to details will check its spread.

The paint technician has known for years that there are certain types of pigments which prevent the formation of rust. A new metal roof, particularly the galvanized type, has a coating left from the process of manufacture to which paint does not readily adhere. Consequently, this must be removed. The most economical procedure is to let

nature do the removing and delay any treatment for at least one year or until the first hints of rust appear. The roof should then receive a coat of either *Red* or *Blue Lead Metal Primer*. This prevents the action of water and air on the roof from creating an acid which in turn causes rusting. The primer, however, must be followed by finish-coat materials. To insure maximum life for the roof, it should then be given a coat of *Black Asphaltum Paint* to be followed by either *Aluminum* or any other of the colored roof paints. Once this has been done, finish-coat materials can be renewed as they weather off.

Delayed Spraying of Tomatoes

Condensed from Farm Research

James G. Horsfall and John W. Heuberger

QUESTIONS about the control of tomato diseases have given the plant pathologist many bad moments during the recent years. The growers knew that diseases were reducing yield badly in many seasons. The diseases were causing yellow fruits, sun-scald, cracking, and other troubles. If the pathologist suggested the old stand-by spray, bordeaux mixture, the yield was not increased as expected but was frequently reduced. Quality was enhanced, but if the spray took 2 tons per acre away in yield, an increase in quality was not welcomed.

These problems have been studied for nine seasons at this Station. The answers are not all in, but many of them are. The three main questions to which answers have been sought are: How does bordeaux reduce yield? Why does bordeaux reduce yield? How can the difficulty be solved?

Briefiy these answers may be summarized as follows: Bordeaux is a highly alkaline spray because of the lime that it contains. The tomato is sensitive to an alkaline spray. It is especially sensitive when the plant is small. The plant responds in many ways. It usually gives up water faster when sprayed. Its leaves become harsh to the touch like the well-advertised dish-pan hands. The leaves grow gnarled and crooked. The plant grows dwarfed and the flower buds and new shoots may be killed. Finally, the plant responds to the spray by shedding many of its blossoms. It is no wonder that bordeaux reduces yields.

The simplest solution to this

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problem would be to use a neutral or lime-free copper spray. Such a material is to be found in red copper oxide which has been investigated extensively on tomatoes. It can be used in the field. It does not dwarf the plants, nor kill the flowers, nor distort the leaves like bordeaux. In short, it does not reduce the yield like bordeaux. It has been compared with bordeaux in the field during five seasons. It has always out-yielded bordeaux when sprayed all season, altho it may not have controlled diseases quite so well as bordeaux.

This is not to say, however, that other materials in the family of so-called insolubilized copper compounds might not also be effective. None of these, except Coposil, has killed blossoms in our tests, nor dwarfed the plants, nor distorted the leaves. In Ohio and Pennsylvania, copper oxychloride has been studied and found satisfactory on tomatoes.

There is another and very important aspect of this problem of controlling tomato disease in New York and that is the cost. Defoliation diseases do not attack the crop every year and when they do it is usually late in the season. Is it necesary to spray the crop all year every year in order to catch the disease late in some years? That question seems fairly well answered "No" by our 1938 experiments.

Two spray schedules were tried during 1938—spraying weekly during the season and beginning to spray when disease appeared (August 1). At the end of the season, the percentages of dead leaves for the all-season spray and the delayed spray were, respectively, 36.4 and 30.1 for bordeaux mixture, 30.4 and 29.5 for red copper oxide, and 66.4 for the unsprayed plants.

Likewise the yields for ripe fruit in tons per acre for the season were, respectively, 6.96 and 7.59 for bordeaux mixture, 9.27 and 8.39 for red copper oxide, and 7.46 for the unsprayed plants.

The idea of delayed spraying was tried on four commercial farms in 1938. In one case dry weather killed the test. In another case the grower dusted with copper lime dust and reported a doubled yield on the dusted field as compared with a nearby undusted field. He reported also that the dust increased the proportion of U. S. No. 1 fruit from 35 to more than 70 per cent.

In two other cases spraying with red copper oxide and bordeaux was delayed until August 9, when three applications were made with a power sprayer. Yield records were taken on the last picking at each farm. The yields per acre on the two farms for unsprayed plants was 1.21 and 2.71 tons, for red copper oxide spray 3.89 and 2.25 tons, and for bor-

deaux 4.10 and 3.84 tons.

The percentages of leaves dead from blight on the unsprayed plants on the two farms were 79.0 and 89.4, on those sprayed with red copper oxide 33.4 and 51.5, and on bordeaux-sprayed plants 33.4 and 55.0.

Anthracnose on the fruit has accompanied and been aggravated by defoliation in recent years. It lowers the farmer's grade and increases mold in the canned product. The sprays reduced this disease to one-third in the one test field where it occurred in 1938.

Spraying can be delayed apparently until the first leaf dies from blight. That means that no spraying need be done in blight-free years, and it need not be done until late in mild-blight years. Only in severe-blight years will spraying have to be extensive. Delayed spraying will save expense. Each delayed spray will be slightly more expensive than an early-season spray because the plants will be larger. On the other hand, fewer applications need be made. The total cost of a delayed spray schedule will be less than for a whole-year schedule. The fact that sprays need not be applied at all in blight-free years will also save expense.

The feasibility of getting a sprayer thru the fields late in the season has been questioned. Growers say that this can be done by establishing driveways and spraying with a long boom. The driveways can be used later when the crop is picked.

It can be reasonably concluded that heretofore tomatoes have been sprayed (if indeed they have been sprayed at all) in New York state early in the season when spraying was most injurious, most expensive, and least required and that they have not been sprayed late in the season when spraying was least injurious, least expensive, and most required.

Worms, Lice and Mange

Condensed from The Poland China Journal

C. E. Aubel

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HOGS are infested with a number of worms, the most common of which is the round worm. It is very injurious, for it causes digestive trouble, retards growth and development, and affects the general thrift of pigs. It is most harmful to pigs up to 50 pounds in weight. If a pig can be kept free from worms until it weighs 100 pounds or more, injurious effects are not likely to occur.

The pig suffering from a bad infestation of worms has some fever, digestive disturbances followed by scours, and in general is hard looking, with stiff hair and drawn-up flanks. The infestation is caused by swallowing the eggs of the parasite. Eggs pass off in the manure of mature animals which are infested and incubate in the soil several weeks.

Dirty, muddy lots with manure piles and dirty hog wallows are ideal places for the development of the eggs. The eggs are swallowed by the young pigs when they suckle sows whose teats are covered with infested mud. The eggs, but one-four-hundredth of an inch long, after being swallowed hatch in the small intestines of the pigs. In their search for a home, young worms enter the blood stream from the intestines and are carried to the liver.

It is while in the lungs that the young worms, now one-sixteenth of an inch in length, do the most damage. The passing of free young worms through the lungs causes congestion, hard breathing, and penumonia. A severe infestation of young worms in the lungs retards growth. Many runts are caused in this manner. The young worms in the lungs work their way into the windpipe, are coughed up, and then swallowed and pass into the small intestine where they mature in 2½ months. They produce millions of eggs which are passed off in the manure.

This troublesome condition may be handled by a preventive method or a curative method. The former is most recommended. It is known as the McLean County System. This system was worked out by the United States Bureau of Animal Industry in

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co-operation with the hog raisers of McLean County, Illinois. It is outlined as follows:

1. Clean the farrowing quarters and scrub them with 1 pound of lye to 20 gallons of boiling hot water, then spray with 1 pint of compound cresole solution to 4 gallons of water. The hot water kills the worm eggs, the lye loosens the dirt, and the disinfectant destroys the germs of infectious diseases.

2. Wash the sow's udder and sides with soap and water before putting her in the farrowing pen. This removes the worm eggs so that the little pigs cannot get them when they suck.

3. Keep the pigs confined to the farrowing pen, if it is in the vicinity of old hog lots, until the sow and pigs are moved to clean pasture.

4. Haul the sow and pigs to a clean pasture where no hogs have run for at least 2 years. Preferably this pasture should be a field which has been cultivated since last used by hogs. This avoids contamination from filthy hog lots.

5. Confine the pigs to the clean pasture until they are at least 4 months old.

6. Prevent the development of polluted areas near feeding equipment by moving such equipment occasionally.

The foregoing rules for hog-lot sanitation were so successful in raising hogs in McClean County that the following data from the University of Illinois Circular No. 306 are here presented in order that hog raisers may be fully aware of the importance of sanitation in swine production. These data are based on records of 13,478 pigs raised from 1,977 sows on 154 farms in Illinois by the use of the sanitary system, and are compared with a large number of pigs raised in permanent hog lots on the same farms.

By using the sanitary method, 98.2 percent of the pigs farrowed were raised. An average of 1.6 to 2.7 more pigs per litter were raised. The size of the litters was increased more on farms formerly having the greatest trouble with small litters. The same number of pigs were produced by 28 percent fewer sows. The number of runts was reduced from 18 out of every 100 to 1 out of every 100, and finally, pigs raised by the sanitary system weighed an average of 27 pounds more at 4 months old than those raised by the permanent-lot system. The sanitary-system pigs reached marketable size 7 weeks earlier and weighed 28 pounds more than the permanent-lot pigs.

Three methods are commonly used in giving the curative worm treatment. These methods are the slop, drenching, and pill. All require that the hogs to be treated should be fasted for 24 hours so

as to free the intestines from food in order that the medicine may have its full effect on the worms. No matter which method of worming is employed, a thorough understanding of the principles is necessary.

The slop method is satisfactory, and consists of incorporating in thin slop, for each 50 pounds of live weight of pig, 4 grains of santonin and 2½ grains of calomel. The pigs to be treated should be separated into conveniently small bunches of not more than 20 head so that each pig will receive its proper share of the dose. This is easy for the average person to administer, but has the disadvantage that the sick pig which needs the treatment often will not take its share of feed and medicine. For such pigs one of the individual dosing methods may have to be used.

The drenching method involves giving the dose through the mouth by means of a syringe. A satisfactory dose consists of 2 cubic centimeters of oil of chenopodium (oil of wormseed) to 1 ounce of castor oil for each 50 pounds of pig.

The third method is the pill method. There are many brands of worm capsules and tablets on the market. Some are good, others are not. When administering capsules or pills the throat may be injured or the capsule may stick in a pouch in the neck. Also pills may not always contain a full dosage.

About weaning time young pigs frequently scratch and rub themselves, especially if their dams are scratching and rubbing. A close examination will disclose the presence of lice or mange.

Lice are external parasites commonly found on swine. They live by suckling the blood and lymph from the hog, and are usually found on the tender parts, which are the backs of the ears and between the legs. Lice are easily controlled by the application of used crankcase oil which has been thinned by adding a little kerosene. It may be poured over large hogs from a sprinkling can and then spread over all parts with a broom or mop. Little pigs may be crowded into a corner and the oil poured on them. Jostling and crowding under and over one another usually spreads the oil thoroughly over them.

Mange is a contagious skin disease caused by a small mite that burrows into the skin and produces intense irritation. The condition spreads rapidly because the mites reproduce in 12 to 14 days. The discomfort causes the pigs to rub and scratch, which tends to spread the mites and infect all of the hogs that are yarded together.

To treat mange, it is best to first separate the infected hogs

from those that are not infected. The lime-sulphur treatment is the best, especially for severe cases. A dry form of lime-sulphur is convenient and may be secured commercially. It is considered less effective, however, than the liquid form. One part of dry lime-sulphur to 10 gallons of water is the amount usually recommended for dipping. The liquid form, or lime-sulphur solution, is the same as is used by orchardmen. For hog dipping it is used in the proportions of about 1 gallon of the solution to 25 gallons of water. The water should be about 125 degrees F., and the hogs may be dipped in this hot solution in a dipping tank, or a barrel, or may be sprayed and scrubbed with a brush. The effectiveness depends upon the thoroughness of the job. Severe cases require repetition of the treatment 2 weeks apart. Waste crankcase oil has some value in treating for mange. Mild cases usually respond to several oilings. One part of liquid cresole compound mixed with the waste oil adds to its efficiency for treatment of mange.

Disease-Resistant Potatoes

Condensed from New Jersey Farm and Garden

F. J. Stevenson

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THE most authentic report of the beginning of potato growing in the United States shows that potatoes were first grown in New Hampshire in 1719 from stock brought from Ireland. It was for this reason, no doubt, that it was called the "Irish" potato, a name still used and useful especially in the South, where it serves to distinguish the white potato from the sweet potato. From this small beginning the potato industry has grown in the last two centuries until in 1937 the crop was estimated at nearly 400,000,000 bushels.

It is believed that during the first century after its introduction not many new varieties of importance were produced. During the second century, however, a relatively large number of varieties have come and many of them have gone.

In spite of the fact that many varieties have been tried, not one has yet been found combining all the desirable characteristics. Some of them excel in certain

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characters but are very deficient in others. The Irish Cobbler, for example, is adapted to a wide range of growing conditions but produces rough, deep-eyed tubers and relatively low yields. The Green Mountain produces high yields of tubers of good market and cooking quality in favorable environments but is very susceptible to a great number of potato diseases. It is the work of the potato breeder to find varieties which will be superior to these. In so doing he must take into consideration a large number of characters, such as shallowness of eye, desirable shape, good cooking quality, high yield, adaptation to various environments, and resistance to many of the diseases that contribute much to the labor and cost of production of the potato crop. This increase in cost of production runs into millions of dollars each year and in spite of the efforts made to provide the consumer with potatoes fit for consumption, millions of bushels are annually lost.

Among the diseases which contribute to these losses are common scab, Rhizoctonia, wilts, blackleg, late blight and the virus diseases, such as mild mosaic, latent mosaic, leafroll, spindle tuber and yellow dwarf. It is estimated that the loss from late blight alone has averaged approximately 9,000,000 bushels for the past ten years. It is little wonder then that there has been a decided demand for disease-resistant varieties and a concerted effort on the part of potato breeders throughout the United States to produce such varieties, resulting in a co-ordinated national potato breeding program, in which the U. S. Department of Agriculture and all interested states closely co-operate.

The group of diseases caused by viruses are perhaps the most wide-spread and baffling. These virus diseases occur in every potato-growing region of the country, and it is probable that not a single field could be found entirely free from them. They are not new. Their effects have been observed by growers for many years, but for a long time it was thought that they were due to "running out" or "degeneracy" brought about by growing potatoes year after year from the same tuber stock. It is only a few years since it was discovered that these troubles are due to viruses. It was soon observed that some varieties did not "run out" so quickly as others or as we now say, some varieties are more resistant to the attacks of certain viruses than others. Knowing that such differences must have a genetic basis, breeders are working to obtain resistance to these diseases in combination with other characters of economic importance.

The U. S. Department of Agriculture has been successful in producing a large number of seedling varieties resistant to one of the commonest virus diseases known as mild mosaic. This is the one which has caused the greater part of the "running out" in the Green Mountain variety. There is a wide variation in the reactions of seedling varieties to this disease. Some are hghly resistant, not contracting the disease in the field even when grown year after year within three feet of mild mosaic Green Mountain plants; others contract the disease rarely in the field; still others are susceptible but express the symptoms in a mild form; and the fourth group contract mild mosaic as readily as Green Mountain, that is, 100 per cent of the plants may become infected in the field exposure tests in from one to three years and the symptoms give the plants the typical "run out" appearance so well known to potato growers.

Another virus causes the latent mosaic. This was so named because it is carried in certain varieties such as Green Mountain, without showing any disease symptoms, or these varieties are what is known as masked carriers of the disease. The symptoms on other varieties are quite severe, however, resulting in top necrosis or killing of the vines. One seedling variety has been produced which is immune to this disease, and the immunity has been shown to be heritable, thirty-seven per cent of two crosses between this seedling and other varieties showing the same character for immunity.

Another disease which takes its toll from the grower's profits is common scab. The organism causing this disease lives over in the soil and is carried also on the tubers. Treatments have been recommended which kill the organism carried by the tuber, but no one has yet devised a treatment to protect the growing tubers from the soil-borne organisms. The behavior of a comparatively large number of varieties under widely different conditions indicates that resistance to scab occurs in the potato in varying degrees. Immunity has not as yet been found. Some of the American commercial varieties, such as Russet Rural, Russet Burbank and Mahr's Russet, have been known for a number of years to be resistant to scab. A number of recent introductions from Europe are also resistant. Krantz and Leach, working in Minnesota, have a number of lines from which they obtained scab-resistant segregates. Golden, a new variety recently introduced to the trade by the Bureau of Plant Industry of the U. S. Department of Agriculture, has shown a considerable degree of resistance to

scab in a number of tests, as has also seedling variety 44537. Several of the European varieties, such as Hindenburg, Richter's Jubel, Ackersegen, Arnica and Hindenburg X Centifolia No. 9, which were introduced because of their resistance to this disease, proved to be highly resistant in the scab tests in Maine. All these introductions produced less than one per cent of the amount of scab found on the Green Mountain checks. None of them had enough scab lesions on the tubers to classify them as scabby potatoes, while the Green Mountain tubers could not have been sold for table stock. Golden produced about one-fifth as much scab as the Green Mountain checks. The North American varieties, Russet Rural, Russet Burbank and Mahr's Russett, were intermediate in their resistance.

A relatively large number of crosses have been made in an effort to determine the breeding behavior of some of these varieties. A number of interesting results have been obtained. The progeny of a cross between two susceptible varieties were all susceptible. Another cross between two resistant varieties, Ostragis and Hindenburg, produced a progeny all resistant to scab in preliminary tests.

A large number of both the russet and smooth segregates showed resistance as compared with the Green Mountain variety. A number of selections having shallowness of eye, desirable shape , color of tuber and vigor, as well as resistance to scab, have been selected. None of these may prove their value as commercial varieties, but they do point to the possibilities in breeding for resistance to common scab.

Late blight, caused by Phytophthora infestans, adds more to the cost of producing the potato crop in the United States than perhaps any of the other diseases. The largest loss in the last ten years, according to reports of the Division of Mycology and Disease Survey, occurred in 1928, an estimated total of 31,000,000 bushels. That year blight was reported from fifteen states, with the loss in New York given as approximately 13,000,000 bushels. In 1932 the crop reduction was estimated at about 9,000,000 bushels, nearly all of which was reported from Maine. The disease reached epidemic proportions in Maine again in 1936, but it was less severe in 1937. These epidemics have increased the interest in breeding varieties for resistance to blight.

In 1910 the U. S. Department of Agriculture began a program of breeding for resistance to this disease under direction of Dr. William Stuart. The work had not progressed very far, however, when it became evident

that the virus diseases had to be given chief consideration, and it was not until the present national potato breeding program was initiated that emphasis could be placed once more on breeding for resistance to blight.

Dr. Reddick, of Cornell University, and a number of European workers have been attacking the problem by using species hybrids. The U. S. Department of Agriculture is making an attempt to see what progress can be made with varieties and strains of Solanum tuberosum. It has long been known that cultivated varieties of potatoes show various degrees of susceptibility, but so far no variety of this group has been found immune to the attacks of the forms of Phytophthora infestans, prevalent in this country. Varieties have been introduced from time to time, however, which were distinctly more resistant than the sorts commonly grown here but which, because of their extreme lateness, low yield, poor quality, or other undesirable characters, never were distributed to any great extent.

Some of these varieties, together with certain seedlings obtained from crosses and selfed lines which showed resistance in the blight epidemic of 1932, have become the foundation stock in the breeding program. Since 1932 a comparatively large number of varieties and seedling progenies have been tested, with the result that hundreds of seedling varieties were only slightly injured in the 1936 epidemic which completely killed the Green Mountain checks at least a month before normal maturity. The epidemic in 1937 war far less severe, but the results confirmed those of 1936.

So far the discussion has been based on the resistance of the vine, but it has been found that the tubers of a number of the seedling varieties that show vine resistance are resistant also to tuber rot caused by the late blight fungus. Reiner Bonde, of the Maine Agricultural Experiment Station, tested the tubers of a number of these by surface inoculating them with blight spores and placing them in a moist chamber in a temperature conducive to development of rot. A number of the seedling varieties remained free from rot except where the skin was broken, but the Green Mountain checks rotted completely in a very brief space of time.

Contrary to the opinion of some, when disease resistance is emphasized in a breeding program other characters of importance are not lost sight of. Selections have been made from the resistant sorts each year for the last five years, taking into consideration shape of tuber, depth

of eye, and vigor. These have been increased and tested for yield and cooking quality. One of the most promising of these is S-44488, recently named "Sebago." This is a selection from the cross Chippewa X Katahdin, two susceptible varieties. It has been subjected to a number of epidemics of late blight since it was selected in 1932 but has been only very slightly injured in any of them. In the tests of Sebago at Presque Isle, Maine, the six-year average yield of primes for this variety in 390 bushels as compared with 384 bushels for Green Mountain. This is not a significant difference in the light of the probable error for these tests, but the data show satisfactory yields for the seedling variety. Recent cooking tests of tubers grown on the Aroostook Farm place the new variety in the same class as Green Mountain.

As a result of this breeding work, six new varieties have been tested, described, named and increased or are being increased for distribution: Katahdin, Chippewa, Golden, Houma, Earlaine, and Sebago. These six varieties are all resistant to mild mosaic. Katahdin was the first variety introduced by the department, and for that reason it is the most widely known of the new introductions. It has had its ups and downs but is still on the increase, especially in Maine, Michigan and Colorado. Chippewa is a medium early variety, has high yielding ability and is widely adapted. It is being increased as rapidly as the available supply of seed stock will permit. Golden is a yellow-fleshed variety similar to almost all of the potatoes used for food in Germany. There is a small demand for this type in the United States; where it can be grown successfully it is prized because of high yields, good cooking quality and scab resistance. It will not go far as a commercial potato, however, because of its short rest period, as a result of which the tubers sprout badly before they can all be sold on the market. The Houma is a high yielding, high quality potato resistant to mild mosaic. There is little seed of this variety available, but it is on the increase. Earlaine is a new early variety about as early as the Irish Cobbler, but producing much smoother tubers. It is not so widely adapted as the Cobbler but is much prized by a few of the Maine growers who have given it a trial because of its earliness and its superior market quality. The Sebago in repeated tests for six years has proven to be moderately resistant to late blight and highly resistant to mild mosaic under field conditions. It is a vigorous-growing variety that produces comparatively high

yields of tubers with high market and cooking quality. It seems to be adapted to conditions in Maine and certain locations in New York. Because of its lateness it will probably not be adapted to sections where an early crop is produced. It ought to be especially valuable in the parts of those regions subject to late blight epidemics that cause serious losses in spite of attempts to control the disease by spraying. There are not more than 300 bushels of seed stock of this variety available for distribution.

The U. S. Department of Agriculture has no seed stock of any kind for free distribution or for sale. The distribution is made only through the State Experiment Stations.

Although much has been accomplished and the growers are beginning to profit by the efforts that have been made in their interests, the work has just begun. Results so far indicate that in the course of time and by use of the best breeding methods a variety will be developed in which will be combined the most desirable characters such as high yield, good cooking quality, shallow eyes, desirable shape and resistance to the many diseases that at present contribute so much to the cost of producing a potato crop.

Fertilizing for Fruit

Condensed from American Fruit Grower

ON the trail of up-to-date fruit fertilizer recommendations, U.S.D.A. researchers have found that a well-developed 20-year-old apple tree needs from three-fourths to one pound of actual nitrogen each year for maintenance of good growth and fruiting. They have so studied nitrogen usage by the apple that their findings show about one-fourth to one-third pound of the nitrogen being used for development of a heavy fruit crop, one-third to one-half pound for a vigorous foliage system, and about one-fourth pound for new wood, bark, and root tissues which are laid down each year. And they add that this amount of nitrogen is carried in four pounds of cyanamid or sulphate of ammonia and in five pounds of nitrate of soda. But because of leaching, matting by sod, or other conditions, it is necessary to apply greater quantities of the nitrogen carriers than four or five pounds.

At Beltsville, Md., experiments have proved that while some nitrogen will be taken up by roots whenever it is present in available form, the intake of nitrogen is greatest when the tree is in foliage. Present findings of the U.S.D.A. workers indicate that readily available forms of nitrogen will be taken up by the roots from the soil solution and stored in the roots over winter following fall applications after foliage has fallen.

But because a stream of water is continually passing into trees in foliage, they recommend making fall applications about a month before leaf fall and at or near full bloom for spring applications. This assures maximum intake of nitrogen and at the same time results in the beneficial residual condition where cyanamid is used, providing a continual feeding solution for roots during the winter. When cyanamid is used in the spring, its application should be from a month to six weeks before active growth gets under way, since its availability is somewhat slower than the other carriers.

For greatest economy in the use of nitrogen fertilizers, they should be applied in the areas where there is relatively little competition from cover crops or sod, says Dr. J. R. Magnes, of the U.S.D.A. In most of our mature orchards, he adds, there is relatively limited growth of sod under the tree branches. He

Reprinted by permission from the American Fruit Grower, Cleveland, Ohio

and his co-workers recommend that nitrogen be spread from the branch ends inward toward the trunk.

On most orchard soils tree growth is largely determined by nitrogen intake. Already mentioned are amounts of nitrogen needed for mature trees. But applications must be larger than the theoretical requirements if the quantity of actual nitrogen needed for the tree is to be supplied.

If one pound of actual nitrogen is to be the yearly minimum for each tree, at least five pounds of cyanamid or sulphate of ammonia and six pounds of nitrate of soda must be applied. In some cases even this amount may be insufficient, especially under heavy sod or cover crop conditions. Important, too, is the necessity of suitably fertilizing cover crops to lessen their competition with trees for soil nutrients.

Should complete fertilizers be a part of the tree feeding program, they must contain the same amount of nitrogen as stated above for the standard carriers.

Much of the experimentation covering fertilizer needs of deciduous fruits has centered on the apple. But the other fruits, too, respond to fertilization—particularly to nitrogen. Peach tree growth and yields, especially, have been appreciably increased. A criterion for nitrogen application to peaches is that enough be supplied to provide terminal growth of from 16 to 24 inches in length. A general recommendation for nitrogen application is one-third pound of any of the standard carriers for each year of the tree's age. In certain areas potash has been a necessary addition to the peach fertilizing program. Definite deficiency symptoms indicate the need for potash.

Apricots, cherries, and plums are benefited by the application of nitrogen. Tree growth and yields are the indexes of fertilizer use by these fruits.

Because of fire blight dangers, pear and quince trees under cultivation are given little or no fertilization. If orchards are in sod, one of the quickly available nitrogen carriers applied about a month before growth starts will aid early growth and setting of fruit. In turn, greater growth of the sod because of the fertilizer application usually checks later tree growth, bringing about hardening of the wood which increases fire blight resistance.

Brambles, like tree fruits, respond when nutrients are added to soils in which they grow. As with other fruits, nitrogen is the principal fertilizer for brambles. In general, an annual application of 250 to 300 pounds of a standard nitrogen carrier per acre is the bramble recommendation. During the first season, nitrogen

fertilizer may be applied in a circle six inches from the plants.

Southern strawberry growers have found that a 4-12-4 or 5-15-5 commercial fertilizer gives strong, healthy, high-yielding plants. In northern regions, there is frequently little need for strawberry fertilizing if a good culture system is followed. However, on poorer soils, side dressing with a complete fertilizer during the first year has given good results.

Over a 26-year period, F. E. Gladwin, of the New York Experiment Station has found that a grape plot fertilized with 250 pounds of nitrate of soda, 300 pounds of superphosphate, and 200 pounds of muriate of potash per acre outyielded check plots by 61 per cent. Another part of this test shows potassium to be more helpful with nitrogen than phosphorus.

Besides the variety of plant nutrients discussed here, there are instances of deficiencies of several of the lesser known elements. This is particularly important in some of the eastern coastal plain sections extending from New Jersey southward through Florida and reaching northward again in those soils bordering the gulf. In New Jersey, especially, complete fertilizers as well as lime are being currently recommended for orchards. Some inland areas, too, have soils that produce trees with definite nutrient deficiencies other than that of nitrogen. Most of the trouble associated with these areas is caused by lack of potassium. One recently discovered successful preventive for corky core or drought spot in areas where fruit is affected is the addition of borax to soils.

Not to be overlooked in any fruit fertilizer discussion is use of manure. Where available, a light manure mulch, especially for young trees, has given good results in getting growth of the new stock off to a fine start. Care must be taken in using a mulch that it is not placed too near the trees. Mice prefer mulch for nesting and will cause damage to trees if the mulch provides a cover close to the trunks. For best results, well-rotted manure should be used.

These examples of recurring variations serve to point out the possible diversity of fruit nutrient needs. Experiences of growers in using fertilizers and continued research by professional workers will serve to clarify tree feeding problems as they appear in the future.

INDEX

Beef Cattle

Cow Herds Make the Forage Market ..... March, 1938
Beef Production Costs ..... March, 1938
Fattening Calves on Milo Grain .. March, 1938
Beef without Grain ..... April, 1938
Fattening Cattle on Pasture ..... July, 1938
Bunching, 1938 Style ..... Sept., 1938
Making Beef with Ayrshire Steers . Oct., 1938
Calves Prefer Oats ..... Oct., 1938
Care of the Herd Bull ..... Nov., 1938
Limestone Feeding ..... Nov., 1938
Application of Breeding Laws ..... Dec., 1938
Importance of Breeding Matrons ... Jan., 1939

Conservation

Soil Conservation Service ..... Feb., 1938
The Menacing Morning Glory .... March, 1938
Pioneer in Conservation ..... July, 1938
Perpetuation of Wild Life ..... Nov., 1938
What Has Happened to the Shelter Belt, Dec., 1938
A United Front to Reclaim the Dust Bowl, Dec., 1938
Terraces Increase Yields ..... Jan., 1939
Water in the Ground is Cash in the Bank, April, 1939
Tempering the Wind with Trees ... April, 1939

Crops

Crotalaria is Good for Southern Soils Feb., 1938
A Grass that Fattens ..... Feb., 1938
Forage Crop Engineering ..... March, 1938
Repeat Profit ..... March, 1938
Our Old Friend Timothy ..... March, 1938
Rare Crops ..... March, 1938
Danger of Unadapted Clover Seed April, 1938
An Adventure in Grass Farming . April, 1938
When There's a Snake in Sudan Grass, July, 1938
Barley's Future ..... May, 1938
Increasing Protein Content of Timothy, June, 1938
Handling Hybrid Seed Corn ..... June, 1938
Hayways ..... July, 1938
Certified Grimm Alfalfa ..... Sept., 1938
History of Hay Making ..... Oct., 1938
Seed Treatment for Small Grains .. Nov., 1938
Permanent Clovers ..... Nov., 1938
Artificial Drying of Roughage .... Nov., 1938
Story of Yorkwin Wheat ..... Nov., 1938
Made-to-Order Corn ..... Nov., 1938
Nutrients, Not Tons per Acre .... Nov., 1938
When Wheat Follows Soybeans .... Nov., 1938
Streamlining a Rotation ..... Nov., 1938
Clover Farmer ..... Dec., 1938
Flax as a Gulf Crop ..... Dec., 1938
Winter Barley ..... Dec., 1938
Inoculation for Legumes ..... Dec., 1938
When Buying Hybrid Corn ..... Dec., 1938
Good Crop for Low Land ..... Dec., 1938
Birdsfoot Trefoil ..... Dec., 1938
New Blight-Resistant Milo ..... Jan., 1939
Sea Island Cotton ..... Feb., 1939
Fighting Stem Rust ..... March, 1939
Seed Treatment ..... March, 1939
High Quality Roughage ..... March, 1939
High Quality Alfalfa ..... March, 1939
Hybrid Grain Sorghum ..... March, 1939
Growing Grass for Seed ..... March, 1939
Grass and Clover Seed Cost Money . April, 1939

Dairy Cattle

Raising Dairy Calves ..... Feb., 1938
Index Ghosts ..... March, 1938
Genes, the Basis of Breeding .... March, 1938
Production Records ..... April, 1938
Do High Testing Cows Produce More Fat? May, 1938
New Treatment for Mastitis ..... May, 1938
Danish Dairying .....
Plan for Livestock Improvement ... June, 1938
High or Low Pressure Dairying ... June, 1938
Feeding Experiments ..... July, 1938
Artificial Breeding Society ..... July, 1938
Why Cows Leave Home ..... Sept., 1938
Breeding Dairy Cattle ..... Sept., 1938
Way to Stop Milk Flow ..... Oct., 1938
What Happens to Herd Sires ..... Oct., 1938
Dairy Experiments ..... Oct., 1938
Minerals for Dairy Cattle ..... Nov., 1938
Why Some Calves Die Young ..... Nov., 1938
Artificial Insemination Progress ... Dec., 1938
She Lost Two Quarters, But .... Jan., 1939
Improving the Curd Size of Milk .. Jan., 1939
Milking Shorthorn Cow ..... Jan., 1939
Bang's Disease ..... Jan., 1939
Blood Transfusions for Calves ..... Feb., 1939
Brown Swiss Cattle ..... Feb., 1939
Taking the Bull Visiting ..... Feb., 1939
Calf Raising Problems ..... Feb., 1939
Trim Your Bull's Feet ..... Feb., 1939
Milk in Gallon Jugs ..... March, 1939
Cleaning Gutters No Chore ..... March, 1939
Good Doers Make Good Milkers ... April, 1939
Medal Sire Cost $52.50 ..... April, 1939
Inheritance of Milk Secretion .... April, 1939
Selection of a Herd Sire ..... April, 1939

Farm Machinery

Winter Gas Engine Troubles ..... Feb., 1938
Tractor Costs Then and Now ..... Feb., 1938
Tractor Care ..... May, 1938
Types of Pumps for Farm Use .... July, 1938
Hay Choppers ..... Sept., 1938
Lubricating Oil ..... Oct., 1938
Increasing the Farm Water Supply . Oct., 1938
History of Farm Implements ..... Nov., 1938
The Combine Harvester ..... Jan., 1939
Short Cut in Liming ..... Jan., 1939
Anti-Freeze for Tractor Tires ..... Feb., 1939

Fruit

Re-evaluating the Dwarf Fruit Tree Feb., 1938
Pollination of Fruit Trees ..... March, 1938
Peach Mosaic ..... March, 1938
The Man Behind the Spray Gun .. April, 1938
Raspberry Varieties ..... April, 1938
New Manchu Apricots ..... May, 1938
Alternate Bearing ..... May, 1938
New Varieties of Tree Fruits .... June, 1938
New Aspects of Fertilization ..... June, 1938
Orchard Irrigation ..... July, 1938
Raising Quality Fruit ..... Sept., 1938
How to Grow Bush Fruits ..... Oct., 1938
Late Keeping Grapes ..... Oct., 1938
Too Many Bruised Apples ..... Oct., 1938
Peach Progress ..... Nov., 1938
Use of Peat Moss in Planting Trees . Dec., 1938
Incubator Fruit Trees ..... Dec., 1938
Citron Being Produced ..... Dec., 1938
Cover Crop for Orchards ..... Jan., 1939
Profitable Pruning ..... Feb., 1939
Dwarf Fruit Trees ..... Feb., 1939
Peach Orchard Development .... March, 1939
Transporting Trees When in Leaf . March, 1939

INDEX

New Chemical to Control Peach Borer, April, 1939
Fighting Fire Blight ..... April, 1939
Wound Protectants ..... April, 1939

Fertilizers

Fertilizer Analysis ..... March, 1938
Mixing Your Own Fertilizers ..... April, 1938
Fertilizer Placement ..... May, 1938
Fertility Loss Must Be Figured ..... May, 1938
Small Tonics Increase Yields ..... June, 1938
Phosphatic Fertilizers ..... July, 1938
Fertilizers for the Dairy Farm ..... July, 1938
Drilling Fertilizer ..... Sept., 1938
What Are Fertilizers? ..... Sept., 1938
Humus and Fertilizers ..... Sept., 1938
Your Soil's Limiting Factors ..... Oct., 1938
Soil, Fertilizer Action and Plant Nutrition, Oct., 1938
Functions of Organic Matter ..... Oct., 1938
Where to Place Fertilizers ..... Jan., 1939
Boron Deficiency Becomes a Problem Jan., 1939
Keep Manure Piles Wet ..... Jan., 1939
Production of Artificial Manures ..... Jan., 1939
Balanced Plant Nutrition ..... Feb., 1939
Fertilizers for Soybeans ..... March, 1939
Getting the Most out of Nitrogen ..... March, 1939
Side Placement of Fertilizer ..... April, 1939

Hogs

Pre-farrowing Management ..... March, 1938
Studies in Hog Type ..... April, 1938
Swine Sanitation Plan ..... April, 1938
Pig Yardstick ..... May, 1938
Outbreeding Best ..... May, 1938
No Pig Wants to be a Runt ..... June, 1938
Pigs, Pasture and Protein ..... July, 1938
Thrifty Pigs ..... Sept., 1938
Pork-Makers ..... Oct., 1938
Bacon for Breakfast ..... Nov., 1938
Selling on Carcass Grade ..... Dec., 1938
Feeding and Fattening Hogs ..... Jan., 1939
New Hog Method ..... Feb., 1939
Protein Supplements ..... Feb., 1939
Tether System of Pig Breeding ..... Feb., 1939
Methods Employed in Swine Breeding, March, 1939
Pre-Farrowing Management ..... April, 1939
Ton of Pork Twice a Year ..... April, 1939

Horses

That Dread Horse Disease ..... April, 1938
Minerals and Good Horses ..... July, 1938

Pastures

Intensive Pasture Management ..... Feb., 1938
Seeding Permanent Pastures ..... March, 1938
Improving Depleted Ranges ..... April, 1938
Pasture Improvement ..... May, 1938
New Models in Pasture Plants ..... May, 1938
Longer Grazing Seasons ..... June, 1938
Restoring the Range ..... Sept., 1938
Anthrax ..... Nov., 1938
By-Products Profits ..... Dec., 1938
Ultra Violet Lamps for Poultry ..... Dec., 1938
Keep Your Litter Dry ..... Dec., 1938
Developing Pastures in Florida ..... March, 1939
More Grass for Dairy Cattle ..... April, 1939
Deferred System with Rotation Pasture, April, 1939

Poultry

Shall We Heat the Laying House ..... Feb., 1938
Fresh Air in the Incubator ..... March, 1938
Producing Market Eggs ..... Ap
New Turkey Disease ..... Ap
Batteries vs. Range System ..... Ma
Internal Quality of Eggs ..... Ma
These Frozen Eggs ..... Ma
Battery Brooding ..... Ju
Individuality Among Hens ..... Ju
It Pays to Insulate ..... Ju
Milk Increases Turkey Profits ..... Ju
Manganese Prevents Slipped Tendons, Ju
Ventilation for Poultry Houses ..... Ju
Culling Cuts Costs ..... Se
Is Chick Sexing a Luxury ..... Se
Stop Coccidiosis ..... Se
White Oak Quail Farm ..... Oc
Progress in Poultry Feeding ..... Oc
Artificial Lights for Poultry ..... Oc
Why Do Chickens Lay Such Eggs ..... No
At the Finish ..... No
Eggs and Vitamins ..... No
No Monopoly on New Ideas ..... No
Profits from Smoked Turkeys ..... Ja
Crossbreds Win Acceptance ..... Ja
More and Better Poults per Breeder ..... Ja
How Thick Whites Get That Way ..... Fe
Heredity and Environment ..... Fe
Influence of the Hatching Date ..... Fe
Turkey Incubation Goes Commercial ..... Fe
Preventing Coccidiosis ..... Mar
Prolapse and Pickouts ..... Mar
Baby Capons ..... Mar
Geese as a Sideline ..... Mar
Egg Auctions Prove Their Value ..... Ap
Count Your Chicks Before They Hatch Ap
Virginia State Game Farm ..... Ap

Sheep

Cornbelt Sheep ..... Mar
Wool ..... Ap
Sheep Scab Mite ..... Ju
Protect Your Sheep ..... Se
Make Lambs Market Toppers ..... Oc
Feeding and Breeding for Market ..... No
Sweet Potatoes for Sheep ..... De
An Investment in Lamb Production ..... De
More Pounds of Wool per Ewe ..... Ja
Chop Roughage for Lambs ..... Ap

Silage

Straw Silos ..... Fe
Grass Legume Silage ..... Ju
Construction of Trench Silos ..... Se

Vegetables

Conn. Straightneck Squash ..... Ap
Tricks in Veg. Breeders Trade ..... Ap
Growing Trellis Tomatoes ..... Ma
Know Your Spinach ..... Ma
Nutritional Requirements of the To
Battling Garden Bugs ..... Se
Wax Keeps Vegetables Fresh ..... Ja
Certified Seed Potatoes ..... Fe
Chemical Soil Fumigation ..... Ma
Growing Plants without Soil ..... Ma
New Methods for Tomato Growers ..... Ma
Fertility for Vegetable Production ..... Ap
Root Pruning Young Plants ..... Ap

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